4–6 Module

Unit 4
Proper Management of Household Hazardous Waste

Lesson 1
Hazardous Products in Your House

Lesson 2
No Household Hazardous Wastes in a Landfill

Lesson 3
The Consequences of Improper Management of Household Hazardous Waste

Lesson 4
Proper Management of Household Hazardous Waste

Lesson 5
Promoting Proper Management of Household Hazardous Waste

A very organized unit that builds on itself. I really enjoyed teaching the unit. The incorporation of literature was a breath of fresh air. My students really got into this unit. Almost all of the class did the homework assignments. It led to productive class discussions and writings. They were very interested—relatively new idea for them. They had no idea they could or should not throw away household hazardous waste, particularly batteries.

— Stacy Byers, sixth-grade teacher, Cajon Park Elementary School, Santee Elementary School District

4–6 MODULE

Unit 4: Proper Management of Household Hazardous Waste *Overview*

UNIT 4'S CONCEPTS

- Individuals who are thoughtful and cautious in managing materials, including household hazardous wastes, will help reduce contamination in the home and community making them cleaner and safer places in which to live.
- "People need to exercise judgment, care, and planning in disposing materials." (*Science Framework*, page 125)

The five lessons in this unit are described in the outline that follows.

LESSON 1: HAZARDOUS PRODUCTS IN YOUR HOUSE

Lesson's concept: The average home contains numerous products that are potentially hazardous if stored or used improperly.

In Lesson 1 students will:

- Read and analyze labels on empty household products and complete a chart related to such issues in the classroom and at home.
- Identify words that mean that products are hazardous and use a chart to categorize hazardous substances.
- Design brochures about ways to use safely household products which may be hazardous.

LESSON 2: NO HOUSEHOLD HAZARDOUS WASTES IN A LANDFILL

Lesson's concepts:

- People, through their expectations, lifestyle choices, and personal use of resources and products, create varying amounts of waste, some of which may be hazardous.
- Household hazardous wastes should not be placed in the garbage. Household hazardous wastes that are placed illegally in garbage cans end up in a landfill and could potentially cause environmental and health problems (e.g., leachate polluting groundwater) associated with burying hazardous waste in landfills.

In Lesson 2 students will:

- Listen to a simulated letter from a garbage collector to learn why household hazardous wastes should not be placed in the garbage.
- Use models of landfills that they constructed in a previous unit or make new model landfills to design demonstrations on how household hazardous wastes affect the groundwater; and/or conduct experiments on leachate.
- Observe how water picks up pollutants in a landfill model, which they will create in a bottle.
- Sing a song about landfills and write a letter to the garbage collector describing what they did and what they learned in this lesson.
- Research, write about, and report to the class information about a local landfill and its connection to their community's water system.

LESSON 3: THE CONSEQUENCES OF IMPROPER MANAGEMENT OF HOUSEHOLD HAZARDOUS WASTE

Lesson's concept: Any disposal of used motor oil and other household hazardous wastes can harm the environment and people.

In Lesson 3 students will:

- Observe a demonstration of simulated used motor oil poured on soil and water.

- Listen to the story *Someday a Tree* by Eve Bunting and conclude that disposing of household hazardous waste on the ground pollutes the environment and can kill trees and other plants.
- Trace the path that rainwater would take from the school grounds to a storm drain and find out what local body of water the storm drain feeds into.
- Predict where household hazardous waste could end up if it were disposed of on the ground.
- Complete a chart to identify the damaging effects of the improper disposal of hazardous household waste.

LESSON 4: PROPER MANAGEMENT OF HOUSEHOLD HAZARDOUS WASTE

Lesson's concepts:

- Household hazardous waste must be carefully separated from other wastes and taken to a household hazardous waste collection facility.
- Used motor oil must be taken to a used oil collection center.

In Lesson 4 students will:

- Visit the school bus yard and interview a mechanic to find out what happens to used motor oil and used motor oil filters from school buses.
- Find out where in their community used motor oil can be recycled.
- Listen to a speaker describe the proper way to manage household hazardous waste.
- Determine that by recycling used motor oil and other recyclable household hazardous wastes, natural resources are conserved and the environment is protected from pollution caused by the improper disposal of wastes.

LESSON 5: PROMOTING PROPER MANAGEMENT OF HOUSEHOLD HAZARDOUS WASTE

Lesson's concept: Education and publicity can help encourage people to manage properly their household hazardous waste.

Students select one of the following projects to complete to teach others what they have learned about household hazardous waste:

- Design posters to inform students and other community members that the only way that household hazardous wastes can be managed properly is to take them to a household hazardous waste collection facility or event in their community.
- Compile a list of facts about used motor oil or other household hazardous waste and design a community display.
- Make hanging signs for door handles with reminders to recycle used motor oil, used motor oil filters, used antifreeze, and paint.
- Make a coloring book for younger students on the importance of avoiding household hazardous products or of managing waste properly.
- Write a letter to parents or guardians to inform them about household hazardous waste.
- Write a jingle about the proper management of household hazardous waste.

Required Book to Implement Unit 4

- **For Lesson 3:**

  Bunting, Eve. *Someday a Tree.* New York: Clarion Books, 1993.

PROJECTS

Projects provide experiences in service learning and project-based learning to students and allow them to apply what they have learned in the classroom. The following describe projects that address this unit on the proper management of household hazardous waste. Teachers are encouraged to select one of these projects to implement or to have their students develop one of their own. If students implement an applicable project, they and their teachers are encouraged to send a description of the project to the California Integrated Waste Management Board's Office of Integrated Education, MS-14A, P.O. Box 4025, Sacramento, CA 95812-4025.

- **Project 1:** If a landfill is located within the drainage area of your community, students obtain samples of water from nearby creeks, streams, and reservoirs. They can test the water samples for various pollutants. Students can also go on a field trip and visually evaluate the stream or other bodies of water. They

can observe how clear the water is, whether aquatic insects live there, and whether fish and other wildlife are present. This can indicate the health of the stream or reservoir. See the "Resources" section for curricular guides to help you with this project. (Lesson 2)

- **Project 2:** Students stencil storm drains to let people know where the water ends up. For example: "No Dumping, Flows to Willow Creek" or "No Dumping, Flows to Ocean." (Lesson 3)

Note: Lesson 5 focuses on students conducting a project. A list of projects are provided in that lesson.

Other Project

El Verano Elementary, El Verano, Sonoma Valley Unified School District[1]

Mr. Neubacher's fifth-grade class, concerned about the use of insecticides in their community, brought in a natural insect remover—bats. The students built bat boxes and donated them to local vintners and private homes to increase the bat population.

[1]"Jiminy Cricket's 1997–98 Environmentality Winners." The Walt Disney Company, Inc., and the State of California's Environmental Education Interagency Network.

NOTES

LESSON 1: Hazardous Products in Your House

LESSON'S CONCEPT

The average home contains numerous products that are potentially hazardous if stored or used improperly.

PURPOSE

Students will learn to analyze labels from containers of household products.

OVERVIEW

In this lesson students will:

- Read and analyze labels on empty household products and complete a chart related to such issues in the classroom and at home.
- Identify words that mean that products are hazardous and use a chart to categorize hazardous substances.
- Design brochures about ways to use safely household products which may be hazardous.

CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS

- Students read labels of household products and identify words that mean that these products are hazardous.
  - "It is important to know as much as possible about substances [in household products] because, among other reasons, many are dangerous if not used knowledgeably. They may be dangerous in themselves, they may combine to form dangerous mixtures, or their use may have undesirable long-term effects." (*Science Framework*, page 47)
- Students develop charts about household hazardous products.
  - Students "interpret one- and two-variable data graphs to answer questions about a situation." *(Mathematics Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 18)
- Students describe in their journals some labels that indicate that the product is hazardous. They also write in their journals some safety rules concerning the use of household hazardous products.
  - Students "use traditional structures for conveying information (e.g., chronological order, cause and effect, similarity and difference, and posing and answering a question)." *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 23)

SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, classifying.

TIME

45 minutes to prepare for the lesson; 90–120 minutes to implement the lesson

VOCABULARY

corrosive, ignitable, hazardous material, household hazardous waste, reactive, toxic

PREPARATION

___ **1.** Read the "Background Information for the Teacher" at the end of this lesson.

___ **2.** Obtain copies of labels from household hazardous products and from nonhazardous products. Obtain enough of these to provide one of each type of label to each group of two to three students. Note that labels may be difficult to remove and removing them leaves the container of household hazardous products unlabeled; therefore, copies of the labels from household hazardous products are recommended. Empty, rinsed-out containers of hazardous products with taped lids for added precaution can also be used. Examples of labels of nonhazardous products include those from containers used for vegetable oil, baking soda, sugar, salt, spices, canned goods, rice, breakfast cereals, dog food, toothpaste, and hand lotions.

___ **3.** Duplicate the chart, "Group Chart for Collecting Data from a Label," for each group of two to three students (page 512). If possible, duplicate the chart on paper that has been used on one side.

___ **4.** Duplicate the charts, "Household Hazardous Products Data Collection Form" (pages 519) and "Hazardous Ingredients and Health Hazards of Some Products" (pages 520 and 521) for each student.

___ **5**. Make transparencies of "Class Data from Labels" (page 513); "Four Categories of Hazardous Substances" (page 514); and "Product Labels, A, B, C, and D" (pages 515-518).

___ **6**. Obtain the phone number of the local poison control center from your community's health services department or waste management agency.

MATERIALS

___ Copies of labels from household hazardous products and labels from nonhazardous products, one of each type of label for each group of two to three students

___ The transparencies, "Class Data from Labels," "Four Categories of Hazardous Substances," and "Product Labels"

___ A copy of "Group Chart for Collecting Data from a Label " for each group of students

___ "Household Hazardous Products Data Collection Form" and "Hazardous Ingredients and Health Hazards of Some Products" for each student

PRE-ACTIVITY QUESTIONS

A. Ask students what they think hazardous products are. *Products that can hurt you if they are used improperly.* List their responses on the chalkboard. Ask students to help you list products found in the home that might be hazardous. (Accept all answers at this time.)

B. Ask students:

- How would you know if a substance was hazardous*? Someone might tell me; I can look at the label.*
- What types of words are often listed on a package to indicate that the contents are hazardous? *Danger, poison, caution; keep away from children and pets.* (Students will learn more about these in this lesson.)
- In its container, a household hazardous product will not harm people or the environment. How might people get exposed to a hazardous product? *By eating or drinking it, breathing it in, touching it.* (You might need to provide hints for younger students to help them answer this question.)

PROCEDURE

A. Ask students, "What will help us in determining whether or not a product can be hazardous?" *Read the label.* Tell students that they will read some labels to identify potentially hazardous products.

- Project the transparency "Product Labels, A" and review the components of the label:

  (a) Type of product: All Purpose Cleaner

  (b) Product's use: Disinfectant

  (c) Name of potentially hazardous substance(s) in the product: N–ALKYL; dimethyl benzyl ammonium chloride

  (d) Warning label: Caution; Keep out of reach of children.

- Provide each group of two or three students with a "Group Chart for Collecting Data from a Label."
- Project "Product Labels, B" and, as a class, record the data for columns A–D from the label. Do not complete column "E" at this time.

- Project "Product Labels, C" and, as a class, discuss why these two products are not considered hazardous. Can they become hazardous if not used properly? *Yes.* How? *If you eat too much of the toothpaste or drink the lotion.*
- Provide a label from a household hazardous product and a label from a nonhazardous product to each group.
- Ask groups to fill in the "Group Chart for Collecting Data from a Label" in columns "A" through "D" (not "E").
- As two groups finish the task, they can exchange labels (if the labels are different).

B. Have students share their data as you or a student writes the results on the "Class Data from Labels" transparency.

C. Project the transparency "Four Categories of Hazardous Substances."

- Tell students that there are four major categories of hazardous substances: toxic, ignitable, corrosive, and reactive.
- Ask students to describe what they think each word means (see "Background Information for the Teacher").
- Ask students to identify some products that might fit into different categories.

D. Ask students to use their "Group Chart for Collecting Data from a Label" and complete column "E" to categorize several of the products they have listed. For example from "Product Labels, A" (you might want to project the label on the overhead projector) the hazardous product category (toxic, reactive, flammable, corrosive) is "toxic."

E. Project the transparency for "Class Data from Labels" and have students describe which category in column "E" should be checked off.

F. Project the transparency of "Product Labels, D." Discuss one of the safety rules concerning household hazardous products: Read all labels carefully.

- Ask students to read the label on product D.
  - What does the information on the can of the spray paint tell us? *That the contents are extremely flammable; vapor is harmful; contents are harmful or fatal if swallowed; before using, carefully read cautions elsewhere on label.*
  - What category or categories of household hazardous substance is this product? *Ignitable and toxic.*
- Remove the transparency.

G. Discuss why household hazardous products should never be mixed. (They could react with each other and give off a poisonous gas or could explode.)

H. Discuss why it is not a good idea to put a product in a different container. *Someone else might not know that this container contains a hazardous product; if there was some product left in the container and you pour another product into the container, they could react with each other and give off a poisonous gas or could explode.*

I. Discuss what might be an appropriate and safe way to handle an empty container that had contained household hazardous waste. (You might need to help students with these answers.) *First read the label to see whether there are any recommendations concerning the handling of the empty container. Find out if this type of container is recyclable in your community. If it is not recyclable and there are no special instructions on the label, then you can put this empty container in the trash can to go to the landfill.* (Note that the container must be completely empty; there should not be any free-flowing liquid or material left.)

Note: The proper management of household hazardous waste will be addressed in Lesson 4.

J. Share with students the phone number of the local poison control center. It is_____ .

Journal Prompt: List some safety rules concerning household hazardous products.

K. Ask students to share their journal entries. Develop and post a class list of safety rules concerning the use of household hazardous products.

L. Provide a copy of the chart, "Hazardous Ingredients and Health Hazards of Some Products," for each student. Assign students or groups of students to find the meanings of words from the chart that they might not know, such as carcinogenic, nervous system, digestive system, respiratory system, and urinary system. Ask students to share with the class what they have learned.

(Use school's letterhead.)

Dear Parent or Guardian:

Please read the following information with your child:

We are studying household hazardous products. Household products can be hazardous if they have a warning label indicating the following: caution, danger, keep out of reach of children and pets, flammable, poison, etc.

Please assist your child in completing the "Household Hazardous Products Data Collection Form" for six products you have at home. Make certain that the lids are secured before your child handles the container of each product. Also make certain that your child washes his or her hands after handling the containers. Please sign the back of the "Household Hazardous Products Data Collection Form" to ensure that adult supervision was provided during this assignment. Your child should bring the completed form back to class tomorrow.

Please place potentially dangerous household products on high shelves where children and pets cannot reach them.

Thank you,

Homework Assignment: Provide a copy of the chart, "Household Hazardous Products Data Collection Form," for each student. Tell students to take the "Hazardous Ingredients and Health Hazards of Some Products" sheets and to work with an adult to examine labels of five household hazardous products; then complete the data collection form for each of the five products. The students should ask the adults to tighten the lids on any containers they will be inspecting. The adult will need to sign on the bottom of the form. Students should use the "Hazardous Ingredients and Health Hazards of Some Products" to help them complete column "C." Under direct supervision, students can check kitchens, bathrooms, laundry rooms, utility rooms, garages, closets, and hobby or garden areas to analyze labels of potentially hazardous products.

SAFETY NOTE: Remind students that all potentially hazardous products should be handled with care. Containers that are leaking or missing lids should not be handled. A parent or other adult must supervise this homework assignment.

DISCUSSION/QUESTIONS

A. Ask students to share and discuss their findings concerning household hazardous products in their homes.

B. Look at the list that the class started in "Pre-Activity Questions" Part A and ask the students to edit their lists. Then have them add to the list of potentially hazardous products found in their homes. Keep this list until the end of this lesson.

C. Ask students:

- Define "household hazardous product."
- Why would people want to store and handle household hazardous products carefully? (Accept all answers.)

APPLICATION

A. Ask students what safety precautions they should follow when using household hazardous products. *Read the labels and follow directions carefully*. Help students identify additional precautions, such as:

- If the product is corrosive, wear plastic or rubber gloves.
- If the product is ignitable, keep away from heat, sparks, and flame.
- If the product is reactive, do not keep any other open containers around it, and wear gloves and goggles when using it. Do not mix it with any other product.
- If the product is toxic, wear gloves and goggles and use in a well-ventilated area.

B. Ask students to design a brochure to inform others of safe ways to use and store household hazardous products.

Note: Less hazardous alternatives are available to do certain tasks than using some common household hazardous products**.**

Note: For information about the safe management of household hazardous wastes, see Lesson 4 in this unit.

RESOURCES

Videos

Hazardous Waste, Whose Problem Is It Anyway? 1989 (10 minutes) Available from the Environmental Health Coalition, San Diego.

A class goes to different rooms in a house and looks at the problems of household hazardous products and wastes. Discusses the importance of reading labels, storing household hazardous products safely, and managing household hazardous waste properly.

Outta Sight, Outta Mind. 1978 (11 minutes) Available from the Environmental Health Coalition, San Diego.

A grandfather and his grandson are out in a boat and discuss the problems and solutions to household hazardous products and wastes. Stresses the importance of reading labels and using these products safely; also discusses how chemicals can affect us and the proper management of household hazardous waste.

Student's Page

GROUP CHART FOR COLLECTING DATA FROM A LABEL

Names of groups members:_____

_____

A	B	C	D	E			
		Hazardous	Warning				
Type of product	Product use	substance(s)	label	Corrosive	Ignitable	Reactive	Toxic
1.							
2.							
3.							
4.							
5.							
6.							

Transparency

CLASS DATA FROM LABELS

A	B	C	D	E			
Type of product	**Product use**	**Hazardous substance(s)**	**Warning label**	Corrosive	Ignitable	Reactive	Toxic
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							

Transparency

FOUR CATEGORIES OF HAZARDOUS SUBSTANCES

Category of hazard	Product
Corrosive	**e.g., battery acid**
Ignitable	**e.g., paint remover**
Reactive	**e.g., bleach mixed with ammonia**
Toxic	**e.g., pesticide**

Transparency

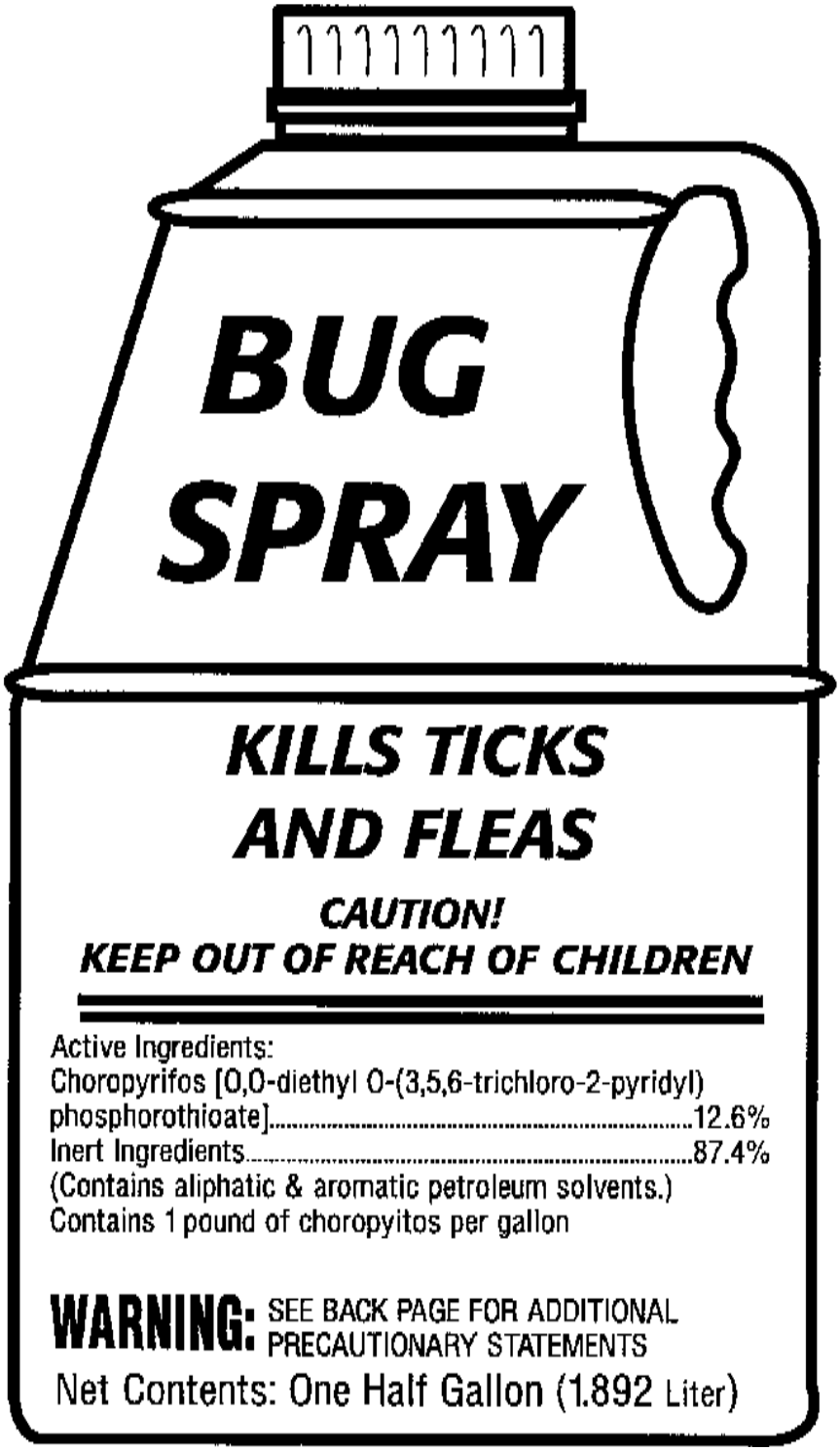
PRODUCT LABELS

A

Transparency

PRODUCT LABELS

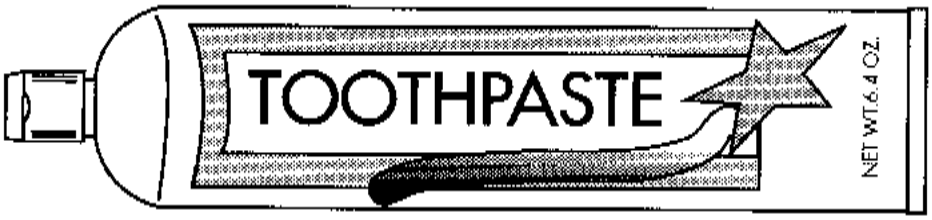
B



Transparency

PRODUCT LABELS

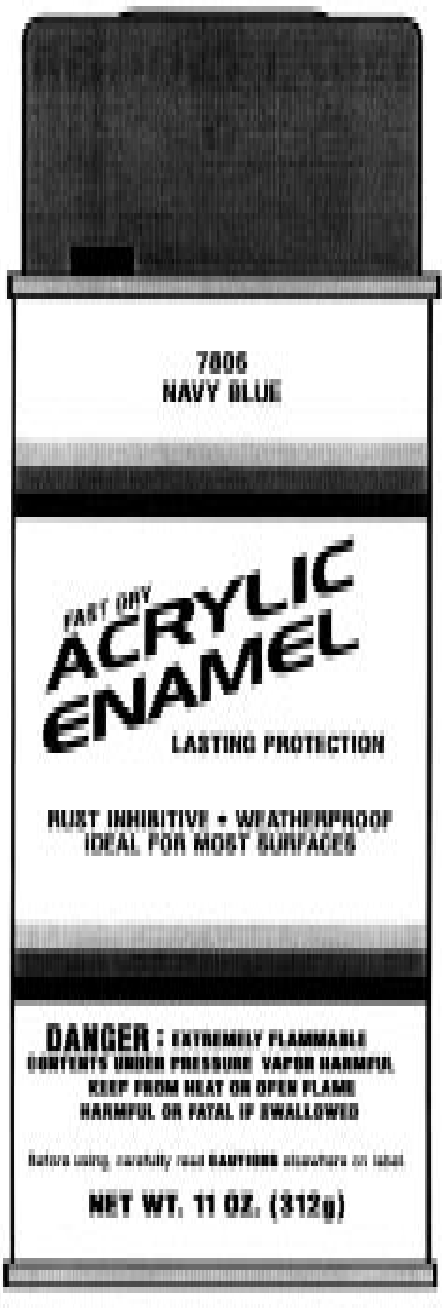
C



Transparency

PRODUCT LABELS

D



Homework Assignment

HOUSEHOLD HAZARDOUS PRODUCTS DATA COLLECTION FORM

NOTE: All potentially hazardous products should be handled with care. Do not handle products that are leaking or missing lids. A parent or other adult should supervise this homework assignment.

Directions: Please work with an adult to examine some household hazardous products. Ask your adult supervisor to tighten the lid to any container whose label you will inspect. Complete this form for five household hazardous products. Check kitchens, bathrooms, laundry rooms, utility rooms, garages, closets, and hobby or garden areas for potentially hazardous products. Use the "Hazardous Ingredients and Health Hazards of Some Products" (pages 520 and 521) to help you complete column "C" of this data collection form.

A	B	C	D	E			
Type of product	**Product use**	**Hazardous substance(s)**	**Warning label**	Corrosive	Ignitable	Reactive	Toxic
e.g., bug spray	*To kill bugs.*	*Methyomyl*	*Caution; keep out of reach of children*				
1.							
2.							
3.							
4.							
5.							

Student's Name: _____ Date: _____

Signature of adult supervising this activity: _____

Student's Page

HAZARDOUS INGREDIENTS AND HEALTH HAZARDS OF SOME PRODUCTS

Product	Hazardous ingredients	Potential health hazards
Air freshneners and deodorizers	Formaldehyde	Toxic; carcinogenic; irritates eyes, nose, throat, and skin; damages nervous, digestive, and respiratory systems
Antifreeze	Ethylene glycol Methanol	Very toxic; damages circulatory and urinary systems Toxic; damages nervous and respiratory systems
Bleach	Sodium hypochlorite	Corrosive; irritates and burns skin and eyes; damages respiratory, digestive, and nervous systems
Disinfectants	Sodium hypochlorite Phenols Trichloroethylene	Corrosive; irritates and burns skin and eyes; damages respiratory, digestive, and nervous systems Ignitable; very toxic; damages respiratory and circulatory systems Toxic; vapor irritates skin, eyes, and respiratory tract
Flea powder	Carbaryl Dichlorophene Chlordane and other chlorinated hydrocarbons*[1]	Very toxic; irritates skin; damages respiratory, circulatory, and nervous systems Toxic; irritates skin; damages nervous and digestive systems Toxic; irritates eyes and skin; damages respiratory, digestive, and urinary systems
Floor cleaner wax	Diethylene glycol Petroleum solvents	Toxic; damages nervous, urinary, and digestive systems Highly ignitable; carcinogenic; irritates eyes, nose, throat, and lungs Ammonia Toxic; vapor irritates skin, eyes, and respiratory tract
Furniture polish	Petroleum distillates or mineral spirits	Highly ignitable; toxic; carcinogenic; irritates skin, eyes, nose, throat, and lungs
Herbicides (weed killers)	Chlorinated phenoxes (contaminated with dioxin)	Toxic; carcinogenic; irritates skin, eyes, and throat
Oven cleaner	Sodium or potassium hydroxide (lye)	Corrosive; burns skin, and eyes; toxic; damages nervous and digestive systems

Items marked with an asterisk (*) are banned or restricted pesticides and should not be used by households.

[1]Chlorinated hydrocarbon pesticides are marketed under the following names: Endrin*, Aldrin*, Dieldrin*, Toxaphene*, Lindane, Benzene*, Hexachloride, DDT*, Heptachlor*, Chlordane*, Mirex*, Methoxychlor.

Student's Page

HAZARDOUS INGREDIENTS AND HEALTH HAZARDS OF SOME PRODUCTS (continued)

Product	Hazardous ingredients	Potential health hazards
Paints	Aromatic hydrocarbon thinners	Ignitable; toxic; carcinogenic; irritates skin; damages digestive and urinary systems
	Mineral spirits	Highly ignitable; toxic; irritates skin, eyes, nose, and throat; damages respiratory system
Paint thinner	Chlorinated aliphatic hydrocarbons	Toxic; damages digestive and urinary systems
	Esters	Toxic; irritates eyes, nose, and throat; damages digestive system
	Alcohols	Reactive; ignitable; irritates eyes, nose, and throat
	Chlorinated aromatic hydrocarbons	Ignitable; toxic; damages digestive and urinary systems
	Ketones	Ignitable; toxic; damages respiratory system
Pesticides	Carbamates[2]	Toxic; damages nervous system
	Chlorinated hydrocarbons	Toxic; carcinogenic; damages nervous system
	Organophosphorus[3]	Toxic; damages nervous system
Toilet bowl cleaners	Sodium acid sulfate or oxalate or hypochloric acid	Corrosive; toxic; burns skin; damages digestive and respiratory systems
	Chlorinated phenols	Ignitable; very toxic; damages respiratory and circulatory systems
Window cleaners	Diethylene glycol	Toxic; damages nervous, urinary, and digestive systems
	Ammonia	Toxic; vapor irritates skin, eyes, and respiratory tract

[2]Carbamates are marketed under the following names: Aldocarb*, Ozamyl, Carbofurna, Methyomyl, Sectran, Propoxur, Carbaryl (Sevin).

[3]Organophosphorous pesticides are marketed under the following names: Phorate, Mevinphos*, Demeton*, Disulfotan, Parathion*, Diazinon, Ronnel, Azinphosmethyl.

BACKGROUND INFORMATION FOR THE TEACHER

In order to accomplish a number of common household tasks efficiently and effectively with minimum effort, people use many products which contain hazardous substances. When we no longer want the contents in a container, the contents become waste. Hazardous waste is discarded material that, when improperly managed, may pose significant threats or potential hazards to human health or the environment. The topic of household hazardous waste will be addressed in lessons 2, 3, and 4. Household hazardous waste is poisonous waste found in homes that can cause problems for living organisms or the environment. This waste can be explosive, toxic, corrosive of metal or skin, disease-causing, radioactive, and dangerous. In this lesson students will focus on household products which may be hazardous.

A product containing a hazardous substance is required to have a label with warning statements and safety information if it is packaged for or intended for use in or around the home. Most household hazardous products are considered hazardous because of the way they affect humans or react with other chemicals.

Household hazardous wastes are considered hazardous because they fit into one or more of the following categories:

- Corrosive: eats away materials and living tissue by chemical action (e.g., oven and toilet bowl cleaners, battery acid).
- Ignitable: ignites easily (e.g., lighter fluid, spot and paint remover, varnish). (Students might be more familiar with the word "flammable.")
- Reactive: creates an explosion or produces deadly vapors when exposed to heat, air, water, or shock or when mixed with other chemicals (e.g., bleach mixed with ammonia-based cleaners).
- Toxic: poisonous when ingested, touched, or inhaled even in small quantities (e.g., rat poison, cleaning fluids, pesticides, bleach, toxic metals such as lead).

The average home contains numerous products that are potentially hazardous if stored or used improperly. A household product is potentially hazardous if the label contains words like "poison," "danger," "warning," "caution," "keep away from heat or open flames," or "keep away from children and pets."

If a product containing hazardous substances cannot be avoided for a specific household task, read its label and follow the directions properly. Make sure that appropriate safety precautions are taken, such as wearing eye protection and protective gloves.

When a project at home is finished, leftover chemicals should be stored safely in the home in their original container. Read the original product label for safe storage requirements; if the label falls off, clearly relabel the storage container; use nonbreakable containers; secure in a tamper-proof area (inaccessible to children and animals); and check regularly for any leaks. Also keep products and wastes away from moisture, water, and food and never mix one product with another.

Pesticides, acids, corrosives and their empty containers, flammables, paints, paint removers, used oil, used oil filters, and wood preservers should be stored until you can take them to a household hazardous waste collection facility or to a location of a scheduled household hazardous waste collection day in your area. (This topic will be addressed in Lesson 3.) For more information see "Appendix B–VI, Household Hazardous Wastes."

LESSON 2: No Household Hazardous Wastes in a Landfill

LESSON'S CONCEPTS

- People, through their expectations, lifestyle choices, and personal use of resources and products, create varying amounts of waste, some of which may be hazardous.
- Household hazardous wastes should not be placed in the garbage. Household hazardous wastes that are placed illegally in garbage cans end up in a landfill and could potentially cause environmental and health problems (e.g., leachate polluting groundwater) associated with burying hazardous waste in landfills.

PURPOSE

Students will learn about landfill leachate. They will conclude that household hazardous waste should not go into the garbage because of the potential hazards to the environment and because it is also illegal.

OVERVIEW

In this lesson students will:

- Listen to a simulated letter from a garbage collector to learn why household hazardous wastes should not be placed in the garbage.
- Use models of landfills that they constructed in a previous unit or make new model landfills to design demonstrations on how household hazardous wastes affect the groundwater; and/or conduct experiments on leachate.
- Observe how water picks up pollutants in a landfill model, which they will create in a bottle.
- Sing a song about landfills and write a letter to the garbage collector describing what they did and what they learned in this lesson.
- Research, write about, and report to the class information about a local landfill and its connection to their community's water system.

CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS

- Using a model of a landfill, students complete and share a plan and then follow the plan to demonstrate how groundwater could become polluted with household hazardous wastes if they are improperly disposed of in a landfill.
  - "Public landfills must be planned responsibly to allow maximal use of the land once it is reclaimed. Toxic wastes buried in landfills adversely affect the groundwater supply and thus affect public water and public health." (*Science Framework*, page 97)
  - "Students listen critically and respond appropriately to oral communication. They speak in a manner that guides the listener to understand important ideas by using proper phrasing, pitch, and modulation." *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 26)
  - "Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept . . . Students will : . . . record data using appropriate graphical representation (including charts, graphs, and labeled diagrams), and make inferences based on those data." (*Science Content Standards, Grades K–12*; Grade 5; Investigation and Experimentation, Standard 6g)
- Students write a letter to Vince, the garbage collector, and describe what they did in this lesson and what they learned.
  - Students "choose the form of writing (e.g., personal letter . . .) that best suits

the intended purpose." *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 37)

- Students research, write about, and report to the class information about a local landfill and any connection it may have to their community's water system.
  - "Water on Earth moves between the oceans and land through the process of evaporation and condensation. As a basis for understanding this concept, students know . . . the origin of water used by their local communities." (*Science Content Standards, Grades K–12*; Grade 5; Earth Sciences, Standard 3e)
  - Students "write research reports about important ideas, issues, or events by using the following guidelines: (a) frame questions that direct the investigation; (b) establish a controlling idea or topic; and (c) develop the topic with simple facts, details, examples, and explanations." *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 31)

SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, classifying.

TIME

45–60 minutes to prepare for the lesson;
90–120 minutes to implement the lesson

VOCABULARY

aquifer, groundwater, leachate, water table (***Note:*** Students can look up these words in a dictionary or science textbook and then draw a model, labeling the parts.)

***Note*:** If available, use the simulated landfill made in a bottle in Unit 1, Lesson 2.

PREPARATION

___ **1.** Read the "Background Information for the Teacher" at the end of this lesson.

***Note*:** Determine which of the following two sections applies to you:

- "Section I, Working with Completed Landfills in Bottles." If you kept the models of the landfill in a bottle from Unit 1, Lesson 2 (4–6 Module), then do Section I in "Preparation," "Materials," and "Procedure." You will use two landfills for the class demonstration and additional bottles for group demonstrations or experiments.
- "Section II, Building Model Landfills in Bottles." If your class does not have landfill models, do Section II in "Preparation," "Materials," and "Procedure." You will be building two landfills in a bottle as a class. Then groups can build additional ones for their demonstrations or experiments.

___ **2.** If available, invite a landfill manager to speak to the class.

For "Section I, Working with Completed Landfills in Bottles"

___ **1.** Gather the models of the landfill in a bottle from Unit 1, Lesson 2 (4–6 Module).

___ **2.** Make a copy of "Our Plan for a Demonstration, Using Our Landfill in a Bottle" (page 535) for each group of students.

___ **3.** Make transparencies of "Diagram of a Landfill" (page 269) and "The Song: Landfill in a Bottle" (page 536).

For "Section II, Building Model Landfills in Bottles"

___ **1.** If needed, precut the 2-liter bottles to prepare them for students to use. Cut Bottle B nine inches from the cap; make an incision with a utility knife and cut around the bottles with scissors. (See "Construction of the Landfill in a Bottle" on page 533.)

___ **2.** Make transparencies of "Diagram of a Landfill" (page 269), "Layers in a Landfill in a Bottle" (page 534), and "The Song: Landfill in a Bottle" (page 536).

___ **3.** Make a copy of "Our Plan for a Demonstration, Using Our Landfill in a Bottle" (page 535) for each group of students.

___ **4.** Obtain maps of your community, which include the location of the landfill where your community's garbage is taken. The maps should show creeks, rivers, and reservoirs. These can be road maps (car

clubs and insurance companies might donate a class set of these) and topographical maps (see "Resources" for sources).

MATERIALS

For "Section I, Working with Completed Landfills in Bottles"

___ A trash can of clean classroom trash, including a couple of empty containers of household hazardous products
___ Plastic tarp on which to spread out the trash
___ Models of the landfill in a bottle from Unit 1, Lesson 2 (4–6 Module)
___ Food coloring
___ Four cups of water
___ Transparencies of "Diagram of a Landfill" and "The Song: Landfill in a Bottle"
___ A copy of "Our Plan for a Demonstration, Using Our Landfill in a Bottle" for each group of students

Note: You might need additional materials for groups designing demonstrations or experiments in landfills in bottles (e.g., pH paper indicator strips).

For "Section II, Building Model Landfills in Bottles"

___ Transparencies of "Diagram of a Landfill," "Construction of the Landfill in a Bottle," "Layers in a Landfill in a Bottle" and "The Song: Landfill in a Bottle"
___ A trash can of classroom trash, including a couple of empty containers of household hazardous products
___ Plastic tarp on which to spread out the trash
___ Four rinsed 2-liter beverage bottles and caps (plus two more for each group of three to four students)
___ One-gallon bucket of regular soil (Do not use potting soil.)
___ Clay soil (soil can be mixed with clay to make the clay soil); approximately half cup per 2-liter beverage bottle
___ More clay or something that can be used as a cushioning material (e.g., piece of rubber foam, sponge, or outdoor carpet) between the plastic liner and the gravel
___ One-gallon bucket of gravel (or crushed rock)
___ Three-inch swatch of cheesecloth or nylon stocking
___ Two pieces of heavy plastic (e.g., a piece of plastic tarp)
___ Scissors, tape, two rubber bands, utility knife
___ A couple of letters from the garbage collector (copy or read from the lesson)
___ Food coloring
___ Two cups of water
___ Assorted small pieces of clean nonhazardous garbage between one-half and one inch in size (apple cores, banana peels, bread, leaves, aluminum foil, bottle caps, rubber bands, paper clips, pennies, cloth, plastic toy, newspaper, copy paper, plastic scraps, grass) to place in the landfills in bottles (Use some materials from the classroom's trash can.)

Note: You might need additional materials for groups designing demonstrations in landfills in bottles (e.g., pH paper indicator strips).

For "Application"

___ Road and topographical maps of your community, which include the location of the landfill where your community's garbage is taken

PRE-ACTIVITY QUESTIONS

A. Have students sit in a circle. Place a package of clean garbage in the middle of the class (including some empty containers used for household hazardous products which have been rinsed out and the cap taped shut). Tell the class that this was just delivered. "Wait there's a letter attached; let's see what it says.

Dear Students,

My name is Vince and I pick up your garbage in my big garbage truck. You may not know me, but I come by your school and your homes every week. I take your garbage to a landfill. A landfill is an area where garbage is buried. How many of you have seen a landfill before?

I sent you some samples from a landfill. Open it up. What would you call this stuff? Do you throw any of this stuff into your garbage can at home?

Notice the empty containers of household hazardous products. I am glad that these are empty. What if they weren't empty? Guess what could happen to me and my friends that work at the landfill if a container half full of household hazardous waste burst open? I'm sure you are careful to not break the law by throwing away household hazardous waste in a trash can. Once

in a trash can, it will be going to the landfill, and there, it could create all kinds of problems.

Thank you for keeping hazardous waste out of your garbage.

Sincerely,

Vince, the Garbage Collector"

B. Discuss with students:

- What happens to the trash after it goes into a garbage can*? A garbage truck picks it up.*
- How does it get in the garbage truck? *Garbage collectors usually pick up the garbage can and dump it into the garbage truck; sometimes garbage companies have machines that lift the garbage can and dump it into the back of the truck. Garbage is compacted in some trucks.*
- Where does the garbage truck take it? *To a transfer station or to the landfill*. (If students do not know what a transfer station is, explain that it is a facility where waste is removed from small garbage trucks and loaded onto larger garbage trucks that take the garbage to a landfill.)
- What could happen to the workers at a transfer station or the landfill if household hazardous wastes were dumped into a trash can*? They could get sick or injured by the hazardous wastes if the container breaks or explodes*.

PROCEDURE

Section I, Working with Completed Landfills in Bottles

Note: Do this section if you have landfills in bottles from Lesson 2 in the unit, "Managing and Conserving Natural Resources."

A. Tell students: "We received another letter from Vince, the Garbage Collector, and it says:

Dear Students,

How have you been? I just got another break from hauling garbage and wanted to drop you another note. There are some important things you should know about landfills. Did you know that when it rains, the water can go right through the landfill and mix with the garbage? If you could look into the landfill, the water might appear black and smelly. This water, when mixed with chemicals from the garbage, is called leachate. *This contaminated water could go down into the soil and into the groundwater. In many areas of California, people dig wells and pump the groundwater to the surface to be used for drinking and washing.*

Well, some people got together and decided that it was important to make sure that landfills do not pollute groundwater. So, they decided to make it a law that all new landfills must have a liner. A layer of clay soil is placed on top of existing soil, and then a plastic liner is placed on top of the clay. Another layer of clay or other material is placed on top of the liner to serve as a cushion to keep the liner from getting pierced by the crushed rock. Then crushed rock is placed on top of the liner, followed by another cushion to keep the soil from sifting into the crushed rock. Finally, a layer of soil is added and the garbage is placed on top of the soil. The liner helps catch the leachate (water that picked up contaminants from the garbage) so it will not enter the groundwater. The collection pipes then carry the trapped leachate out of the landfill to be treated.

I hope you can learn more about how leachate forms in landfills. Maybe your teacher can conduct a demonstration using model landfills. I think you will see how important it is to keep hazardous waste out of our landfill.

Sincerely,

Vince"

B. Discuss what *groundwater* is. Tell students that under the ground there are porous rocks, sand, and gravel through which water can move. This area is called an *aquifer*. In the aquifer is groundwater.

- Show the transparency, "Diagram of a Landfill." Tell students that because groundwater is usually found under a landfill, it is important for the garbage in the landfills to be contained to keep it from polluting groundwater.
- Tell students that they will help you demonstrate how groundwater can be contaminated by wastes in a landfill and how a special liner in a landfill can prevent groundwater contamination.

C. Select two landfills (which you completed in Lesson 2 in the unit, "Wisely Managing Natural Resources") on which to conduct two demonstrations. Label one Landfill #1 and the other Landfill #2. The remaining

landfills can be used when students develop their own demonstrations or experiments.

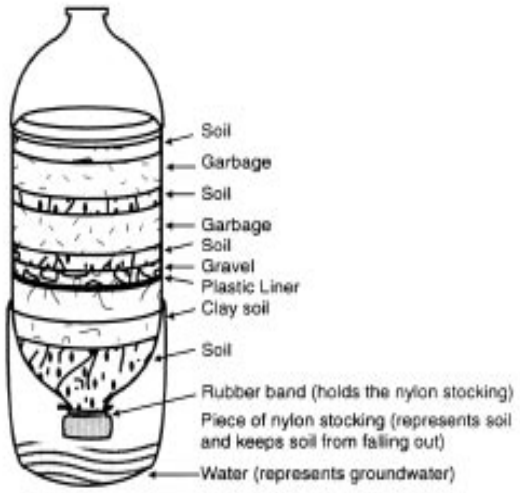
D. Using Landfill #1, open the top of the landfill and dig through the soil until the garbage layer is reached. Ask different students to help you demonstrate the following:

1. Place ten drops of food coloring on top of the garbage. Tell students that this represents the contents of a container containing household hazardous waste that was thrown away into the trash. Explain to students that when the machines compacted the garbage at the landfill, the container with the household hazardous waste burst from the weight. Now it has leaked on the nonhazardous trash.
2. Re-cover the garbage with an inch of soil.
3. Ask students to suppose that the groundwater is located in the soil section below the plastic liner in their model landfills.
4. Simulate rain by pouring two cups of water into the landfill model.
5. Have students observe any color changes in the landfill and in the soil and gravel below the plastic liner. Explain that any colored water they see can represent leachate.
6. Determine whether the plastic liner stopped the leachate (with the household hazardous waste) from going into the groundwater.
   - Ask students to suppose that the plastic liner was torn. How could the groundwater be affected? *It could become polluted unless the clay soil keeps the leachate from reaching the groundwater.*
   - Explain to students that groundwater moves underground and can end up above ground in a spring or creek or other body of water many miles from the landfill site. What can happen to the polluted liquids from the landfill? *They could end up in groundwater and affect the drinking water for many miles.*

E. Using Landfill #2, hold the landfill on its side as you unscrew the screw top on the bottom of the landfill. Have students assist you with parts of the following procedure:

1. Using scissors, poke through the gravel, soil, and clay soil and puncture the plastic liner.
2. Place a piece of nylon stocking (or cheese cloth) over the opening and secure it with a rubber band. This nylon stocking will keep the gravel in the bottle, yet will allow any leachate to leak through. If needed, review the meaning of leachate and leaching. *Leachate is the water that picked up contaminants, and leaching is the process of the water picking up contaminants.* (Note that in most cases the water comes from rain, but liquid can also be present in the garbage.)
3. Add water to the bottom of the base of Bottle A (which will represent groundwater) to just below where the nylon stocking will be when the landfill is placed once more into its base (from Bottle A).
4. Return the landfill to its base.
5. Follow the steps above for Landfill #1, Part D, numbers 1 through 4.
6. Have students observe any color changes in the landfill, in the soil and gravel below the plastic liner, and in the leachate leaking through the nylon. Then have students discuss what they have observed.

F. Ask groups of students to come up with a way to show how household hazardous products, placed in the garbage, can end



up in a landfill and could affect workers at the landfill and/or pollute the environment. Another alternative is to show the importance of a liner, even if no household hazardous wastes are present in the landfill. Students should know that leachate from nonhazardous materials can mix together to create a hazardous liquid. Some examples for demonstrations and experiments are listed below, but groups should be encouraged to come up with their own ideas:

1. A group could pour water through a landfill and, using pH indicator paper strips, can test the pH of the leachate. Students can pour a half-cup of vinegar (to represent a household hazardous substance) into the landfill and test the pH again. They should notice that the pH has gone down, indicating that the water became acidic from the household hazardous waste. (You might have the group gather information about pH through various references and ask them to report their findings to the class.)
2. A group could bury a colorful piece of candy that would represent a leaking container of household hazardous waste. Make sure that the candy will dissolve and emit a color when water is added. (Students can help you identify what type of candy might work best.)

   In the following demonstrations it might be necessary to water for a couple of weeks before the leachate forms from the nonhazardous trash in the model landfill.
3. A group could study suspended solids by draining the leachate (that dripped through the nonhazardous garbage layers) through a coffee filter.
4. A group can study dissolved solids by boiling off the liquid in the leachate and examining and weighing the residue. (This will need to be done with direct adult supervision.) The leachate could also be placed in a sunny location until the water evaporates, leaving a residue (this might take several days).

G. Distribute a copy of "Our Plan for a Demonstration, Using Our Landfill in a Bottle" to each group.

1. Ask students to complete the plan and then share their plans with the class.
2. Once you have approved the plans, allow groups to gather materials and to use landfills in bottles to present their demonstrations in front of the class.
3. Conduct a discussion on the groups' presentations. Note that some demonstrations or experiments might not show obvious results, but the process students went through was most valuable.

Section II, Building Model Landfills in Bottles

Note: Do this section if you do not have landfills in bottles from a lesson in the unit, "Managing and Conserving Natural Resources."

A. Tell students: "We received another letter from Vince, the Garbage Collector. It says:

Dear Students,

How have you been? I just got another break from hauling garbage and wanted to drop you another note. I was thinking: you know everybody uses landfills every day, yet so few people know about them, and nobody wants one near his or her home. Anyway, I thought you might like to build model landfills and learn more about them. It would be a great way to become garbage experts and learn how to keep the environment from becoming polluted.

There are some important things you should know about landfills. Did you know that when it rains, the water can go right through the landfill and mix with the garbage? If you could look into the landfill, the water might appear black and smelly. This water mixed with chemicals from the garbage is called leachate. *This contaminated water could go down into the soil and into the groundwater. People dig wells and pump the groundwater to the surface to be used for drinking and washing. Well, some people got together and decided that it was important to make sure that landfills do not pollute groundwater. So, they decided to make it a law that all new landfills must have a liner. A layer of clay soil is placed on top of soil, and then a heavy plastic liner is placed on top of*

the clay. In some landfills a cushioning material is also placed under the plastic liner. Another layer of clay or other material is placed on top of the liner to serve as a cushion to keep the liner from getting pierced by the crushed rock. Then crushed rock is placed on top of the liner, followed by another cushion to keep the soil from sifting into the crushed rock. Finally, a layer of soil is added and the garbage is placed on top of the soil. The liner helps catch the leachate (water that picked up contaminants from the garbage) so it will not enter the groundwater. In addition, a system of pipes are placed on top of the liner to collect leachate. This leachate is then pumped up and stored until it is treated on site or at another treatment facility.

So you can learn more about how landfills are built, I have given directions to your teacher so you can build your own classroom model landfills.

Sincerely,

Vince"

Note: To demonstrate the process of leaching, especially for younger children, you might want to prepare some model landfills and fill them with different materials, one with soil, one with rock, and one with sand. Then let your students experiment with leaching water through these before you attempt to introduce the idea of groundwater.

B. Discuss what *groundwater* is. Tell students that under the ground there are porous rocks, sand, and gravel through which water can move. This area is called an *aquifer*. In the aquifer is groundwater. Show the transparency, "Diagram A, Diagram of a Landfill." Tell students that since groundwater can be under a landfill, it is important for the garbage in the landfills to be contained to keep it from polluting groundwater. Tell students that they will help you demonstrate how groundwater can be contaminated by wastes in a landfill and how a special liner in a landfill can help prevent groundwater contamination.

C. The following are directions for preparing the bottle for the landfill model in a bottle. See "Diagram B" at the end of the activity to help you prepare these. You will need to prepare two landfills. Cut two 2-liter bottles as shown in the diagram:

- Cut Bottle B nine inches from the cap; for safety, make an incision with the utility knife and then let the students cut around the bottles with scissors (for younger children the 2-liter bottles will need to be precut); if any of the edges are jagged, trim them with scissors and place masking tape over them.
- The base of Bottle A will be the base of the landfill.
- Remove the screw top on Bottle B.
- Cover the top and neck of Bottle B with a piece of cheesecloth or nylon stocking and secure it with a rubber band.
- Turn the top portion of Bottle B upside down and place it on top of the base.
- After filling the landfill, you will place the top of Bottle A on top of the inverted Bottle B to form the cap.
- Recycle the bottom portion of Bottle B.
- Place one-half cup of gravel (about 2 inches) in the bottle to represent the aquifer.

D. Into one landfill, place soil on top of the gravel. Then alternate two inches of assorted garbage with one inch of soil.

E. Tell students that all new landfills require clay soils, plastic liners, leachate collection systems, and gravel to be placed on the ground before garbage is added. The purpose of this is to protect the groundwater from water that has leached through the garbage, collecting pollutants. Note that even if household hazardous wastes were never placed in a landfill, leachate from nonhazardous materials can mix together

A landfill in a bottle constructed by Janet Cohen's sixth-grade students at Gold Trail Elementary School.

to create a hazardous liquid. However, the leachate from household hazardous waste is even more dangerous, and there are people who still illegally dump their household hazardous wastes into their garbage, which goes to the landfill.

- For the second landfill, project the transparency "Layers in a Landill in a Bottle." Have students place the following materials in the order listed:
  - A layer of soil on top of the gravel (or crushed rock)
  - A layer of clay soil about one-inch high on top of the soil
  - A plastic liner over the clay soil
  - A layer of clay or cushioning material
  - A layer of gravel over the liner (or crushed rock)
  - A layer of clay or cushioning material
  - A layer of soil
- Ask students why they were asked to place clay soil, a plastic liner, cushioning material, gravel (crushed rock), cushioning material, and soil before adding the garbage. *To keep the garbage from contaminating the soil and to protect groundwater.*
- Ask students what might be the purpose of the cushioning material. The cushioning material on top of the liner keeps the crushed rock or gravel from piercing the plastic liner, and the cushioning material on top of the crushed rock or gravel keeps soil from sifting down.
- If needed, explain to students that when it rains, the water can go right through the landfill and mix with the garbage. Then this polluted water can percolate through the soil and pollute the groundwater. So before the garbage is placed in a new landfill, or in an area next to an old landfill (if the landfill is being expanded), the following must be placed in the following order: clay soil is placed on top of the existing soil, a liner of plastic is placed of top of the clay soil, then gravel and more soil must be placed on top of the plastic liner. The clay soil and liner help to keep the water, as it filters through the garbage, from seeping into the ground and reaching the groundwater.

F. Provide students with clean pieces of garbage and ask them to place the garbage on top of the soil. They should pile the garbage about two inches high. Then they should cover the garbage with a one-inch layer of soil (see "Layers in a Landfill in a Bottle" at the end of the lesson).

- Ask students why the garbage is covered with soil at the end of the day. *To keep garbage from being moved by the wind; to keep it from creating an odor; to keep insects and other animals away from it.*
- Have students add a second layer of garbage and to top it with a one-inch layer of soil.

G. You have constructed two landfills, one that will leak leachate and one that is designed to contain the leachate.

1. Place ten drops of food coloring on top of the garbage. Tell students that this represents the contents of containers containing household hazardous waste that were placed illegally in the trash can. Explain to students that when the tractors compacted the garbage at the landfill, the containers with the household hazardous waste burst from the weight. Now they have leaked on the nonhazardous trash.

- Gradually, pour two cups of water on top to simulate rainfall; cap the landfill with the top half of Bottle A.
- Ask students to observe and describe what they see going on in their landfill.

H. Do part "F" in "Section I, Working with Completed Landfills in Bottles." Groups of students will come up with a way to show how household hazardous substances that are illegally placed in the garbage and end up in a landfill could affect workers at the landfill and/or pollute the environment. They might also conduct other demonstrations or experiments with leachate. Students will need to make their own landfills in bottles for their demonstrations.

DISCUSSION/QUESTIONS

A. Where did leachate end up in each landfill? *On top of the plastic liner or in the groundwater.*

B. What are the problems of the leaking landfill? *The leachate could contaminate groundwater.*

C. How would a leaking landfill present a problem for the surrounding community? *The people might be using groundwater for drinking, cooking, and for other purposes.*

D. How can you prevent leakage of leachate? (Note that in minimizing leakage through added design features, the cost of placing garbage in a landfill goes up.) *Watch what is thrown away into the garbage can; watch what is placed in the landfill.*

E. Why should household hazardous waste be kept away from landfills? *It can pollute the groundwater and injure workers.*

APPLICATION

A. Sing the song "The Song: Landfill in a Bottle " (sung to the tune of "Time in a Bottle"). (If you do not know the tune to this song, then recite the words as a poem.) Encourage students to write words that describe what they are learning in this unit to tunes they know.

No Poisons in Landfills

(Sung to the tune of "Peanut Butter and Jelly")

Chorus:
Poison, poison in landfills don't mix.
Poison, poison in landfills not good.

First you take the HHW to the hazard place on Saturday or on Sunday.
Then you get a pat on the back, and thank yous, and thank yous.

Chorus:
Poison, poison in landfills don't mix.
Poison, poison in landfills not good.

Next they say you saved the Earth,
You're a hero, you're a hero.
Then you go home with a smile on your face.
You did it, you did it.

Submitted by Janet Cohen's sixth-grade class at Gold Trail Elementary School.

B. Ask students to write a letter to Vince telling him what they have done and learned in this lesson.

Dear Vince,
Thank you for all the information. We have learned a lot about landfills. We learned how dangerous household hazardous products and waste can be to plants, animals, and people. We also learned that when the leachate gets to the groundwater it contaminates our drinking water, so it's important that the leachate does not reach the groundwater. That's why the landfills have plastic liners.

Submitted by Stacy Byers, sixth-grade teacher, Cajon Park School, Santee Elementary School District.

C. Provide maps of your community which include the location of the landfill where your community's garbage is taken and the locations of local creeks, rivers, and reservoirs. If available, invite a landfill manager to speak to the class.

- Have students do research to find answers to the following questions (each question can be given to a group of students to research, write about, and report to the class). Students can also develop their own list of questions to research.
  - Where is the landfill that our school's garbage is taken to and how far away is it from the school?
  - How long has this landfill been in operation? Has a liner been installed?
  - What creeks and other bodies of water are found close to the landfill?
  - Where does our school (or community) get our drinking water? If it comes from a reservoir, are there any connections between the bodies of water near the landfill and the reservoir? If it comes from a well, can the groundwater under the landfill be connected to the groundwater from which our community gets water?
  - If there is no apparent connection between the landfill and our drinking water, what communities are close to the landfill? What type of problems might the landfill create for the nearby communities?
  - How long can this landfill be used? Are there plans for expansion?

- What if our drinking water gets contaminated by the leachate from a nearby landfill? (Students can write a narrative on what they perceive the problems and the solutions would be.)

- After all group presentations, students can be asked to write a research report about key ideas, issues, or situations that (1) frame questions to direct the investigation and establish a controlling idea/topic; and (2) develop the topic with simple facts, details, examples, and explanations.

Project Idea: If a landfill is located within the drainage area of your community, have students obtain samples of water from nearby creeks, streams, and reservoirs. They can test the water samples for various pollutants. Students can also go on a field trip and visually evaluate the stream or other bodies of water. They can observe how clear the water is, whether aquatic insects live there, and whether fish and other wildlife are present. This can indicate the health of the stream or reservoir. See the "Resources" section for curricular guides to help you with this project.

EXTENSIONS

A. Assign students to search the archives of local media for stories about problems with a local landfill. Ask them to note the types of remediation used and the extent to which such measures were successful in alleviating the expressed problems.

B. If possible, arrange to take students to see a local landfill or take slides of landfills to show the class.

RESOURCES

Videos

It All Adds Up (Waste/Pollution). The Outside Story with Slim Goodbody series. Produced by Agency for Instructional Technology (AIT) and the Slim Goodbody Company, 1991 (15 minutes).

Stresses the importance of dealing with waste responsibly and shows various ways in which humans dispose of waste. Encourages students to reduce, reuse, and recycle much of the waste they create.

Kids Talkin' Trash. San Leandro, Calif.: Alameda County Waste Management Authority, 1995. Distributed by the California Integrated Waste Management Board (14 minutes).

The first part of this video shows a landfill. In the rest of the video, students learn how to make less garbage and protect the environment by practicing the four R's: reduce, reuse, recycle, rot.

Curricular Guides

Adopt-A-Watershed series. Hayfork, Calif.: Adopt-A-Watershed, various dates.

A series of activity guides on watersheds designed for various grade levels. Includes curricular guides on wildlife, plant life, geology, fish, and other topics. Includes books for each grade span (e.g., primary, intermediate, high school).

Project WET: Water Education for Teachers. Bozeman, Mont.: Watercourse; and Houston, Tex.: Western Regional Environmental Education Council, 1995.

Contains a variety of activities about water and aquatic systems.

Water Inspectors: Examining Water. Santa Barbara, Calif.: California Aquatic Science Education Consortium, nd.

Lessons include plans on how to make water measuring devices (e.g., Meyer Water Sampler, water density indicator) to test creek or lake water.

Sources of Topographical Maps

Maps can be purchased and a free copy of "Topographic Map Symbols" can be obtained from the Western Distribution Branch, U.S. Geological Survey, Box 25286, Federal Center Building 41, Denver, CO 80225. You will need to obtain a free copy of *California Catalog of Topography and Other Published Maps* to help you identify the map you need before ordering it from the U.S. Geological Survey.

DeLorme Mapping Co. *Northern California Atlas and Gazetteer* or *Southern California Atlas and Gazetteer.* Can be obtained from DeLorme Mapping Co., P.O. Box 298, Freeport, ME 04032.

These contain topographical maps of the specified areas (northern California or southern California).

Many engineering supply stores or stationery stores sell topographical maps.

Websites

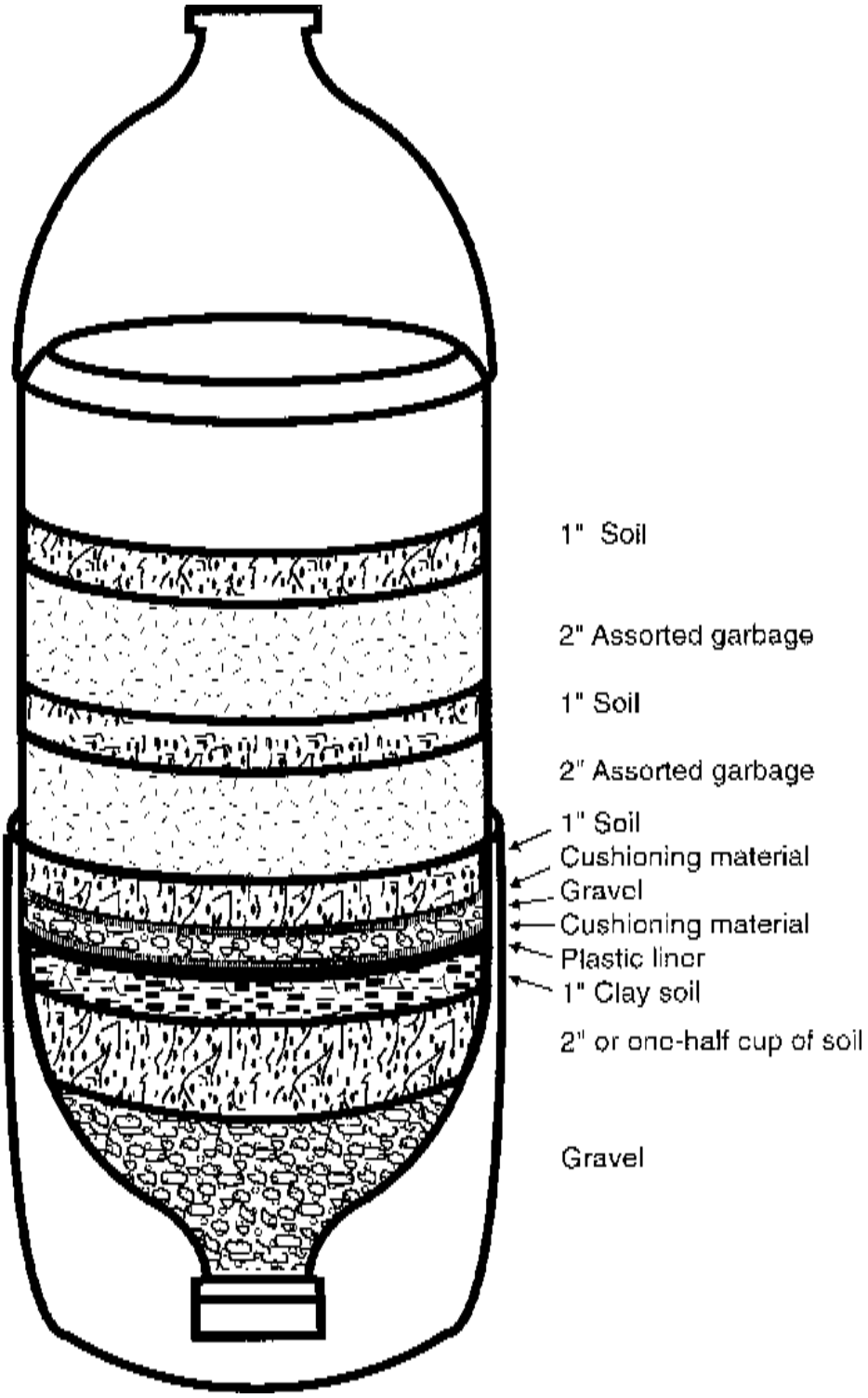
See "Appendix F–III, Landfill websites."

Teacher's Page

CONSTRUCTION OF THE LANDFILL IN A BOTTLE

Transparency or Student's Page

LAYERS IN A LANDFILL IN A BOTTLE



Names: _____

OUR PLAN FOR A DEMONSTRATION, USING OUR LANDFILL IN A BOTTLE

For safety reasons you will not be allowed to use any actual household hazardous wastes for this demonstration. Therefore, you will need to use safe alternatives that could still demonstrate what you want to show.

As a group, please answer the questions below:

1. Using a landfill in a bottle, what do you want to demonstrate that has to do with household hazardous wastes or with leachate?

_____

_____

2. How will you do this?

_____

_____

_____

3. What materials will you need?

_____

_____

_____

4. How long will it take to conduct the demonstration?

_____

5. Get teacher approval.

Extra credit: Draw a picture of the setup of your demonstration. Make sure to label the parts.

THE SONG: LANDFILL IN A BOTTLE

(Sung to the Tune of "Time in a Bottle.")

If I could make a landfill in a bottle,
The first thing that I'd like to do
Is to keep any household hazardous waste
From being thrown in a landfill by you.

If I could protect the groundwater
By lining all landfills right now,
I'd gather all people who'd listen
And explain it to them, with a bow.

But there never seems to be enough money
For solid waste directors to do this;
They try to up the tipping fees,
But not one citizen ever sees
The wisdom . . .

If people recycled their used oil
And reduced their use of all things,
I'd show every one how much happiness
A healthy world with no pollution brings.

If people stopped dumping the wastes
That are hazardous into a dump site,
I'd say everyday till eternity passes away
What we're doing is right.

BACKGROUND INFORMATION FOR THE TEACHER

There are some people that indiscriminately throw household hazardous wastes, such as lead-based paint, used motor oil, nail polish remover, and oven cleaner, into the garbage. Most people do this without realizing the potential threat to garbage collectors or landfill workers who could come in contact with household hazardous waste in garbage. Nor do people understand the significant risk of groundwater contamination that household hazardous waste could pose if dumped in landfills with inadequate safety features, such as lack of plastic liners.

When a household hazardous product is ready to be discarded, it is called household hazardous waste. Note that in most cases, empty containers that contained household hazardous products are not considered hazardous waste if none of the product remains in the container. Whenever possible, household hazardous products should be used up. If not used up, they should be taken to a household hazardous waste collection center or to a collection event. It is illegal to dispose of household hazardous waste in any other way. (More information on this topic is provided in lessons 3 and 4.)

Household hazardous waste should not be placed in a garbage can to be dumped in a landfill because it could cause environmental problems, such as contaminating the groundwater. To learn how household hazardous waste can end up in groundwater, it is necessary to understand the route that water takes as it travels through the water cycle. When it rains, some water runs off into streams, rivers, lakes, and the ocean, and some water seeps down from the surface to the water table or aquifer. An aquifer is a layer of permeable rock, sand, or gravel, where groundwater collects. The water table is the top of the groundwater.

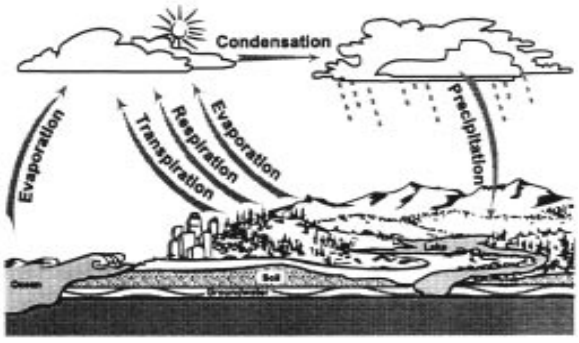
When it rains on a landfill, the passing water can pick up many of the components of our solid waste. Water which has percolated down through substances (such as garbage in a landfill), picking up chemicals or particles of matter as it seeps down, is called leachate. Some chemicals and particles dissolve in the water and move with the water. Hazardous wastes, such as used motor oil, paint products, cleaners, and batteries, all contain chemicals which can contaminate leachate. As other wastes decompose, additional hazardous substances may be produced and dissolve in leachate. Leachate can run off the landfill into streams and other surface waters. If leachate from a landfill seeps down into the ground and reaches the water table, it can contaminate groundwater. With over half of all Americans dependent on groundwater for their drinking water needs, contaminated groundwater constitutes a significant health problem.

Usually, groundwater contamination from landfills can be prevented through specific strategies and the use of technology. The first strategy is for consumers to reduce, as much as possible, the amount of waste they dispose of in landfills. This practice of waste prevention will conserve the natural resources that were used to make the product and also conserve landfill space. It will also postpone the need for creating additional landfills. Note that even discarded products that were not initially hazardous could combine to contaminate leachate.

The second strategy to prevent groundwater contamination is to prevent materials, such as household hazardous wastes, from entering the waste stream that goes to the landfill. People can make certain that they never throw away their household hazardous wastes in the trash. They can take their household hazardous wastes to a local household hazardous waste collection center. The waste materials will then be properly recycled or disposed of in a safe manner that protects against environmental damage. (This topic is explained in Lesson 4.)

Finally, groundwater can be protected through

The Water Cycle



the application of scientific and technological knowledge. For example, the geology of a potential landfill site is carefully analyzed. New landfills are not built on soils which easily transport water. Water can move easily through sand and gravel, but does not flow through silts and clays as easily. This is why a layer of clay soil is first applied to the entire landfill site before covering the site with a thick plastic liner. The clay and plastic liner are required in all new landfills and in the expansion of older landfills. The purpose of the plastic liner and clay soil is to keep leachate from reaching the groundwater. Often a geotextile cushion is placed above, and sometimes also below, the plastic liner, to protect the liner from being punctured.

Landfill operators must also install a leachate collection system to remove the liquid that gathers at the base of the landfill. The leachate is pumped through the pipes to a holding tank and then pumped out of the tank when it is full. It is then transported to a wastewater treatment plant or other waste processing facility.

Monitoring systems on landfills are set up to test the surrounding areas to make certain that preventative measures are working and that groundwater is not being contaminated. In addition, all landfill operators must conduct methane (natural gas) monitoring to ensure that gases given off by the decaying garbage do not become a health or environmental risk. (Note that methane gas production is not addressed in this module.)

In response to growing discoveries about landfill issues, government officials are increasing measures to safeguard the public's health. Existing facilities are subject to inspection and the allocation of specific permits by local health departments or other regulatory agencies. Permits to operate and plans for closure of all landfills must be approved by the California Integrated Waste Management Board. Local enforcement agencies at the county level conduct frequent inspections, and inspections are conducted by California Integrated Waste Management Board every 18 months to ensure compliance with state laws and regulations.

Understanding the role landfills play in managing our solid wastes and their potential environmental impacts will enable us to use our natural resources more efficiently.

The focus of this lesson is on the contamination of groundwater, which can be caused by household hazardous waste placed in a landfill. For additional activities about landfills, see Lesson 2, "Away to the Landfill," in Unit 1 of the 4–6 Module.

For more information, see "Appendix B–IV, Landfill Issues," and "Appendix B–VI, Household Hazardous Wastes."

A geotextile cushion is placed on top of the plastic liner at the expansion site of the Eastlake Sanitary Landfill in Lake County.

LESSON 3: The Consequences of Improper Management of Household Hazardous Waste

LESSON'S CONCEPT

Any disposal of used motor oil and other household hazardous wastes can harm the environment and people.

PURPOSE

Students will become aware that any disposal of used motor oil and other household hazardous waste can have a severe impact on the environment.

OVERVIEW

In this lesson students will:

- Observe a demonstration of simulated used motor oil poured on soil and water.
- Listen to the story *Someday a Tree* by Eve Bunting and conclude that disposing of household hazardous waste on the ground pollutes the environment and can kill trees and other plants.
- Trace the path that rainwater would take from the school grounds to a storm drain and find out what local body of water the storm drain feeds into.
- Predict where household hazardous waste could end up if it were disposed of on the ground.
- Complete a chart to identify the damaging effects of the improper disposal of hazardous household waste.

CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND TO *BENCHMARKS FOR SCIENCE LITERACY*

- Students conduct demonstrations to show that the disposal of used motor oil and other household hazardous waste can harm people and other living things.
  - "Certain poisons in the environment can harm human beings and other living things." (*Benchmarks for Science Literacy,* page 144)
  - "Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept . . . Students recognize whether evidence is consistent with a proposed explanation." (*Science Content Standards, Grades K–12*; Grade 6; Investigation and Experimentation, Standard 7e)
- Students draw and share the maps they have drawn of the drainage patterns on the school grounds and predict into what body of water the rainwater running from the school grounds will flow.
  - "Students will: . . . record data using appropriate graphical representation (including charts, graphs, and labeled diagrams), and make inferences based on those data." (*Science Content Standards, Grades K–12*; Grade 5; Investigation and Experimentation, Standard 6g)
- Students discuss the meaning of the story *Someday a Tree* by Eve Bunting that they listen to or read.
  - Students "identify the main problem or conflict of the plot and explain how it is resolved." *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve,* page 29)

SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing, ordering, relating.

TIME

30–45 minutes to prepare for the lesson; 60–90 minutes to implement the lesson

VOCABULARY

pollution, used oil (Select additional words that students are curious about in this lesson.)

PREPARATION

___ **1.** Read the "Background Information for the Teacher" at the end of this lesson.

___ **2.** Prepare a two-liter beverage bottle for the used motor oil demonstration:

- Cut the top part of the beverage bottle about two inches from the top to make a wide-mouth bottle.
- Poke several holes on the bottom of the container to catch water filtering through. One way to do this is to straighten out part of a paper clip and heat the straight end in a candle's flame and then poke the hot end through the plastic.
- Place gravel on the bottom of the bottle. This will represent the groundwater aquifer.
- Lay a piece of mesh screen or nylon stocking to keep the soil from sifting into the gravel.
- Place two cups of soil on top of the mesh screen or nylon.

___ **3.** Select an area on the school grounds where students can diagram drainage patterns. Locate any storm drains or ditches into which rainwater from the school grounds would drain.

___ **4**. Make copies of student pages on disposal options: "A. Soil or Ground" (page 545); "B. Street or Storm Drain" (page 546); "C. Sink and Toilet" (page 547); and "D. Garbage Can" (page 548).

___ **5**. Make a copy for each group of the student's page, "Where Will It End Up?" (page 549).

___ **6**. Make transparencies of "Where Will It End Up? Effects of Household Hazardous Waste Disposal" (page 550) and "Improper Ways of Getting Rid of Used Oil" (page 551).

___ **7**. If possible, obtain the video, *Recycle This!* from the California Integrated Waste Management Board.

MATERIALS

For "Part I, Conducting Demonstrations with Simulated Oil"

___ Quart jar
___ Empty 2-liter plastic soda bottles
___ Paper clip
___ Candle
___ Scissors
___ Gravel
___ Three cups of soil
___ A piece of 6- by 6-inch window screen or nylon stocking
___ One cup of molasses

For "Part II, Reading or Listening to* Someday a Tree *by Eve Bunting"

___ The book, *Someday a Tree* by Eve Bunting

For "Part III, Investigating the School Grounds for Drainage Patterns"

___ A cup of molasses (to simulate used motor oil) (Do not use real used motor oil because it is a hazardous waste. Note that water may need to be added to the molasses to simulate oil viscosity.)
___ A clear container of unused motor oil
___ Paper towels (several sheets)
___ Paper and pencil for each student on which to draw a map of the parking lot
___ Clipboards or pieces of heavy cardboard with a paper clip (to use as clipboards), one for each student
___ Optional: A map of the school to help students draw the drainage patterns

For "Part IV, Studying How Illegal Disposal of Household Hazardous Waste Can Harm the Environment"

___ Student pages on disposal options: "A. Soil or Ground"; "B. Street or Storm Drain"; "C. Sink and Toilet"; and "D. Garbage Can"
___ A copy for each group of the student's page "Where Will It End Up?"
___ The transparency, "Where Will It End Up? Effects of Household Hazardous Waste Disposal"
___ If available, the video, *Recycle This*

For "Application"

___ Transparency of "Improper Ways of Getting Rid of Used Oil"

PRE-ACTIVITY QUESTIONS

Discuss with students:

- What are some ways that people might dispose of a bucket of dirty water that came from washing their cars with a mild nontoxic soap? List these as students respond. *Pour it on the lawn; pour it on the driveway or street; pour it down the sink or toilet.*

- What happens to the water and dirt if they are poured on the places we just listed. (Accept all answers at this time.)
- Tell students that some people have been disposing of household hazardous wastes, such as used motor oil and paint thinner, in the same ways that we have listed. But it is illegal to dispose of household hazardous waste in those ways. Why do you think that is? List on the chalkboard some responses from students. Tell students that they will learn more about the problems associated with illegal dumping of household hazardous waste in this lesson.

PROCEDURE

Part I, Conducting Demonstrations with Simulated Used Motor Oil

A. Ask students:

- How many of you know people who change their own car oil (instead of taking the car to a gas station or automobile service center to have it done).
- Where do you think the used motor oil is placed by people, once they drain it from their cars? *Poured on the ground; placed in a garbage can; taken to a used oil collection center for recycling.* Note that pouring used oil on the ground or in a garbage can is illegal, but students might not know this at this time.
- Is used motor oil a household hazardous waste? *Yes.*
- Should it be poured on the ground? *No.* (Students might not know this yet.) Tell students that in this lesson, they will learn more about how used motor oil and other household hazardous wastes can affect the environment if these wastes are not managed properly.

B. To show students how used motor oil can pollute soil if poured on the ground, demonstrate the following:

- Place a cup of soil in a quart jar. Pour one-quarter cup of molasses on the soil. Tell students that the molasses is used to simulate used motor oil and that you are not using real used motor oil because it is toxic.
- Encourage students to feel the soil containing the molasses. Ask how easy it would be for plants to grow in this soil if the molasses represented used motor oil, which is hazardous. How will this oil affect the animals, such as earthworms, that live in the soil? *It could kill them.*

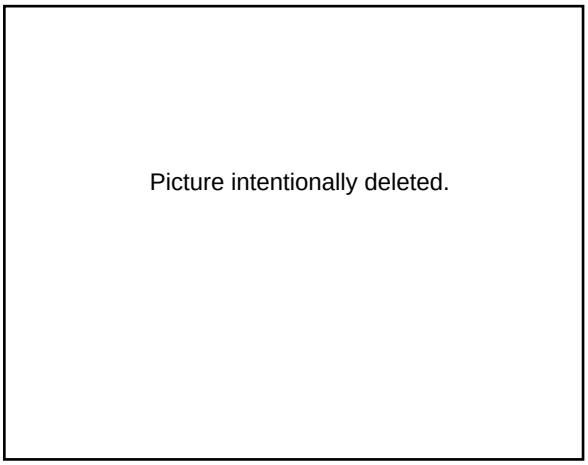
C. To show students how used motor oil can pollute groundwater if it is poured on the ground and rainwater leaches it, do the following:

1. Use the soda bottle you prepared in "Preparation #1." Describe the layers in the bottle: The gravel represents the groundwater. The top of the gravel represents the water table. The piece of mesh screen or nylon stocking is being used to keep the soil from falling into the groundwater aquifer. The soil on top of the gravel represents the soil on land. Molasses represents used motor oil.
   - Pour a quarter cup of molasses on the soil.
   - Simulate rain by sprinkling water on the soil.
2. Ask students to observe what happens to the groundwater. They should describe any color they see.

Part II, Reading or Listening to *Someday a Tree* by Eve Bunting

A. Read to students (or have students take turns reading parts of the book) *Someday a Tree* by Eve Bunting. Discuss:

- What happened to the oak tree? *It died.*
- Why did the oak tree die? *Someone poured something hazardous on the ground under the tree.*
- Why should household hazardous waste never be poured on the ground? *It might kill trees and other plants; it could pollute the groundwater.* (Help students to infer from Lesson 2 that if household hazardous waste in a landfill can pollute the groundwater, the waste can also pollute the groundwater if poured on the ground.)
- Where else might people dump household hazardous wastes that can pollute the environment? *In the*



A student from Janet Cohen's sixth-grade class at Gold Trail Elementary School reads *Someday a Tree* by Eve Bunting.

landfill; into a lake, creek, river or ocean; on the street; into a storm drain. (Students might not yet know about storm drains and their connection to waterways, but they will learn this in this lesson.)

- How else might people get rid of household hazardous waste (legally or illegally)? *Put it in the garbage can; recycle it by taking it to a household hazardous waste collection site.*

Part III, Investigating the School Grounds for Drainage Patterns

A. Ask students why motor oil is used in engines. *To lubricate the engine*. Show students new oil in a clear container. Have them describe the color. It should be golden yellow. Ask students what color they think used oil will most likely be and why? *Black, dirty because it picks up dirt from the engine.* Note that students may not know the reason why used motor oil looks different from new motor oil. Explain that inside the engine, motor oil picks up pollutants, like carbon, ash, and some heavy metals, which is why the engine needs its oil changed on a regular basis.

B. Tell students that they will be exploring drainage patterns on their school grounds. The purpose of this activity is to determine where household hazardous wastes could end up if they were dumped on the ground.

C. If students will have difficulty drawing a map of the school, provide a map of the school for them on which they can draw the drainage patterns. Ask students to bring pencils, paper, and clipboards (or pieces of cardboard with paper clips). Lead students around the school grounds and have them guess where rainwater might flow. Rainwater would flow down from high places to low places.

1. Decide on the signal you will use to gather the students back together.
2. Establish boundaries and have students work in pairs.
3. Instruct students to draw an overhead view of a section of the school grounds and to draw arrows to show the way rainwater might flow.

D. Gather the students in a group.

- Have students figure out what will happen to the rainwater. *Some rainwater will be absorbed into the ground (if your school grounds have unpaved areas); the rest will flow away.*
- Discuss with students where the water will flow or drain to. *Down the street; to a storm drain; into a ditch.*

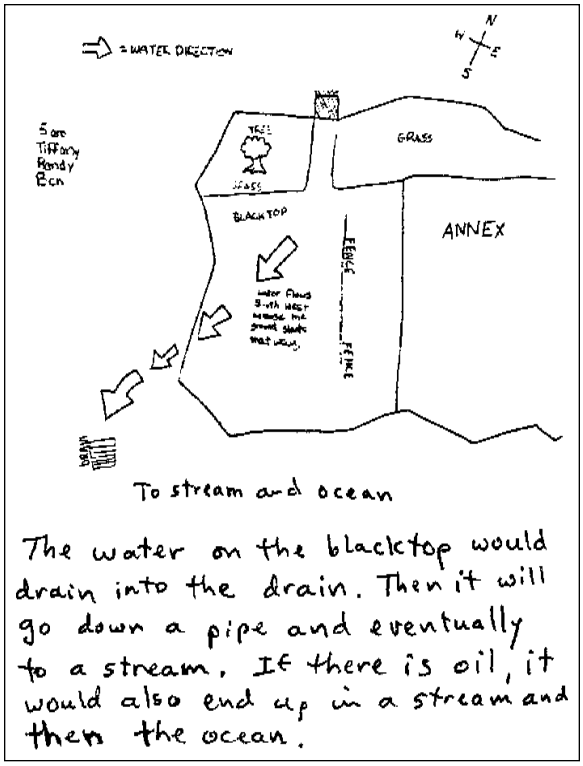
E. If there is a storm drain in the area of the school grounds, have students find it.

- Ask students where the water that runs into this storm drain will end up. (It usually ends up in a nearby creek, river, lake, or ocean.)

F. Back in the classroom, ask how students can find out where the water in the storm drain flows. For example, they can call the department of public works or the flood control office in their community. Ask for a couple of student volunteers to make the phone calls.

G. Once students know where the rainwater from the school grounds drains, ask them to help you trace its path—from the school grounds to a storm drain to a local body of water. This can be drawn on the chalkboard, or students could make a mural on butcher paper.

Where would the used oil go if someone poured it on the school grounds? *It might sink into the soil or sit on the pavement until the rains came, and then it would be washed away into the storm drain and into a natural body of water.*



Submitted by Stacy Byers, sixth-grade teacher, Cajon Park School, Santee Elementary School District.

Part IV, Studying How Illegal Disposal of Household Hazardous Waste Can Harm the Environment

B. Tell students that some management options, such as putting waste in landfills or pouring household hazardous waste on the street, are not legal, but for the purposes of this activity, they will find out where materials would go if they were poured on the street, soil, or down a storm drain; poured down a sink or flushed down a toilet; or put in a garbage can with the trash.

1. Divide the class into groups or pairs and assign a different improper disposal method to each group. Two or more groups could be assigned the same method of disposal.

- A. Soil or Ground
- B. Street or Storm Drain
- C. Sink and Toilet
- D. Garbage Can

2. Assign used motor oil as the household hazardous waste to study. Ask each group to brainstorm for several minutes on where used oil disposed of by their designated disposal method might end up. Questions that each group can ask are:

a. If we dispose of the used motor oil by this method, what might happen?

b. In ways, if any, might other living things, like wildlife and plants, be harmed?

c. In ways, if any, might people be harmed?

d. How could chemicals in this product get into our drinking water?

3. Distribute "Where Will It End Up" and ask the groups to answer the questions and complete the chart for the disposal method that they were assigned.

4. Provide groups with the pages of information on the type of improper disposal that they were assigned. Ask groups to read their pages. Allow groups to change their answers, based on what they have read.

5. Project the transparency, "Where Will It End Up?" Ask groups to share their answers with the rest of the class. Ask them to follow the format for explaining what they have learned: "Before, we thought . . . now we know . . .." For example, the group assigned the soil or ground disposal method would say, "Before, we thought that it was okay to dump used oil on the ground; now we know that it is against the law, because the chemicals in used oil can pollute the soil and even the groundwater if rainwater leaches the chemicals deep into the ground."

6. As each group presents its ideas, mark the chart on the transparency and ask other groups to do so on their charts.

7. After all the options have been covered, review with the class where used motor oil might end up and the damage that it could do.

8. Have students select another household hazardous waste, and as a class complete Chart II on the transparency.

C. If available, show the video *Recycle This* to the class. Discuss the message that the video is presenting.

DISCUSSION/QUESTIONS

A. How could pouring used motor oil into a street affect the animals and plants that live in water? *The used oil could be washed by rain into storm drains and then into a stream, river, lake, or ocean. It can harm them by the substances it contains.*

B. How could used oil in soil and water affect people? *Drinking water could become contaminated.*

APPLICATION

A. Project the transparency, "Improper Ways of Getting Rid of Used Oil."

1. Ask students to describe why each of the disposal methods shown is not appropriate. For example:

- Pouring household hazardous wastes on the soil or on the ground can pollute soil and groundwater; it can kill plants.
- Pouring household hazardous wastes on the street or down the storm drain pollutes water, because storm drains are hooked to pipes that go to creeks, rivers, and lakes or directly to the ocean in coastal areas. Ditches are also connected to a body of water.
- Pouring or placing household hazardous wastes in the garbage can harm the environment, wildlife, plant life, and human life. Garbage collectors have been injured by hazardous household waste. Workers at landfills can also be injured.
- Pouring household hazardous wastes down sinks and toilets affects sewer or septic systems. Wastes are broken down by small organisms, and hazardous substances can kill these organisms.

Note: All of these methods of disposing of used motor oil and other household hazardous wastes are against the law.

Note: Tell students that in the next lesson, they will learn that the only acceptable way to manage household hazardous wastes is by taking them to a household hazardous waste collection facility.

2. Discuss how the "Improper Ways of Getting Rid of Used Oil" apply to used oil filters.

Note: The following journal prompt could be assigned as a homework assignment.

B. Ask students to describe in their journals why household hazardous wastes should never be disposed of in the environment.

C. Ask students to share their journal entries.

Project Idea: Have students stencil storm drains to let people know where the water ends up. For example: "No Dumping, Flows to Willow Creek" or "No Dumping, Flows to Ocean."

D. When it rains (or after a rainstorm), take students on a walk on the school grounds to observe actual drainage patterns. Then have them adjust their drawings of the drainage patterns they completed in this lesson.

RESOURCES

Video

Recycle This. Produced by Seahawk Associates, Inc. Copyright by the Dow Chemical Company, 1990 (38 minutes) For more information call 1-800-441-4369.

A group of high school students explain to their friend the proper way to dispose of used oil for recycling and why used oil should never be poured in the garbage, on the soil, or down the storm drain. Taped live at Reseda High School, Reseda, California.

Book

Bunting, Eve. *Someday a Tree.* Illustrated by Ronald Himler. New York: Clarion Books, 1993.

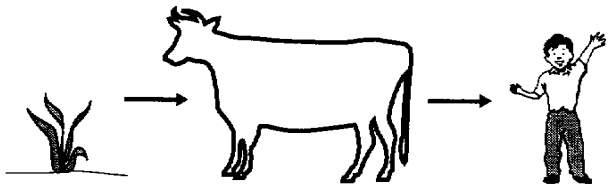
Someone dumps hazardous waste underneath an oak tree, and the oak ends up dying.

Student's Page

A. SOIL OR GROUND

If household hazardous waste is poured on the ground (or in a ditch), it might kill the plants in the area. Also, there's a good chance the waste will end up in a nearby stream, river, lake, or groundwater. Once in the water, household hazardous waste can adversely affect people, wildlife, and other living things.

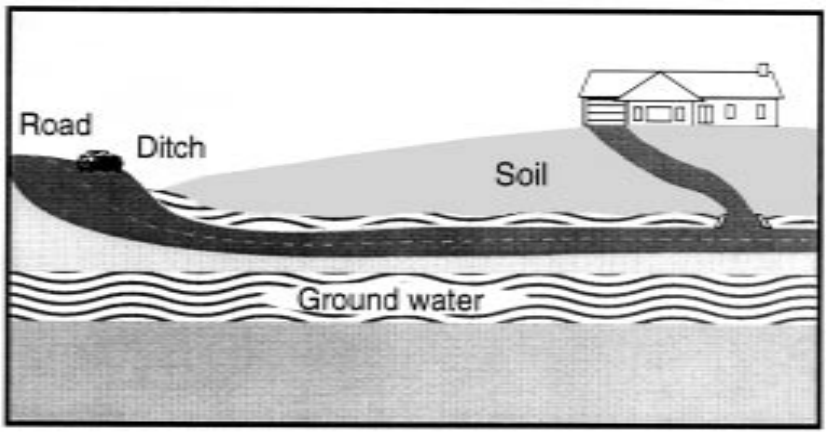
Some hazardous chemicals poured on the ground can be absorbed by plants. When these plants are eaten by animals, the animals may end up with the hazardous chemicals in their bodies. As a hazardous substance moves from one organism to another as a result of being eaten or absorbed, the substance is said to move through a food chain. Each organism, as a link in the chain, may accumulate the hazardous substance in higher concentrations. Human beings are often at the top of a food chain, which means the food we eat could contain a high concentration of some hazardous chemicals.



A food chain

When it rains, the water soaks into the ground, taking with it anything that dissolves in water. This might be chemicals from household hazardous wastes that have been dumped illegally. Water drains or soaks into the ground until it hits an impermeable (difficult to penetrate) layer. The water then collects in the spaces between sand, gravel, or rock particles. Underground areas where groundwater collects are called aquifers. Some aquifers replenish lakes or streams. Others are enclosed by layers of rock and do not move. Wells are drilled into both kinds of aquifers, those that flow and those that are like pockets.

Once the soil is saturated, rainwater runs over land to the nearest ditch or gully and downhill to the nearest waterway. If someone illegally disposed household hazardous waste, such as used oil, in a backyard and it rained hard the next day, the rain would carry the oil over land along the ditches to a waterway or down into the groundwater.



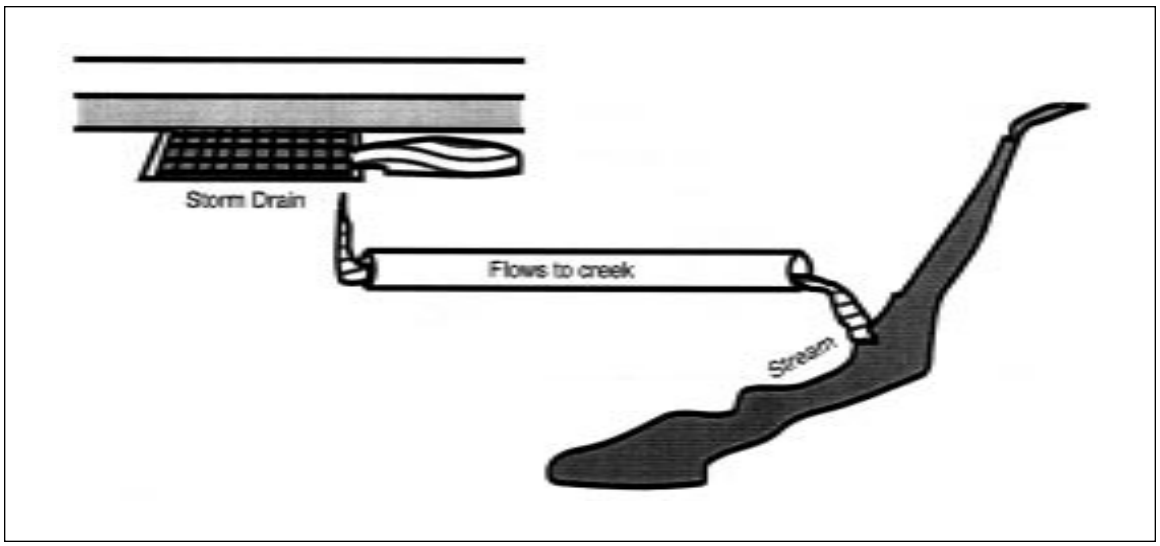
B. STREET OR STORM DRAIN

If a household hazardous waste is poured on the street or in a storm drain, the waste will most likely end up in a nearby stream, river, or lake. Let's figure out exactly where this waste might go.

Let's say that the hazardous waste was poured down the street. When it begins to rain (or people water their lawns), the water runs from streets into the storm drains (square metal grates at the sides or curbs of streets). The rainwater picks up anything soluble (that dissolves in water) or that floats on the water as it flows into the storm drain and also washes along solid materials and oils. Therefore, it will carry almost any hazardous waste.

As the water leaves the storm drain, it enters pipes which carry it to larger underground pipes or "trunk lines." These usually empty the water into the nearest waterway, such as a creek, lake, river, or ocean. So if used motor oil was poured down the storm drain along a street, it may end up on the feathers of ducks or in the gills of fish in a nearby lake or river.

In some communities the storm drains join sanitary sewer pipes and the runoff water goes to a sewage treatment plant. In this case water containing hazardous waste will be treated. What kind of sewage treatment systems do you have in your community?



Student's Page

C. SINK AND TOILET

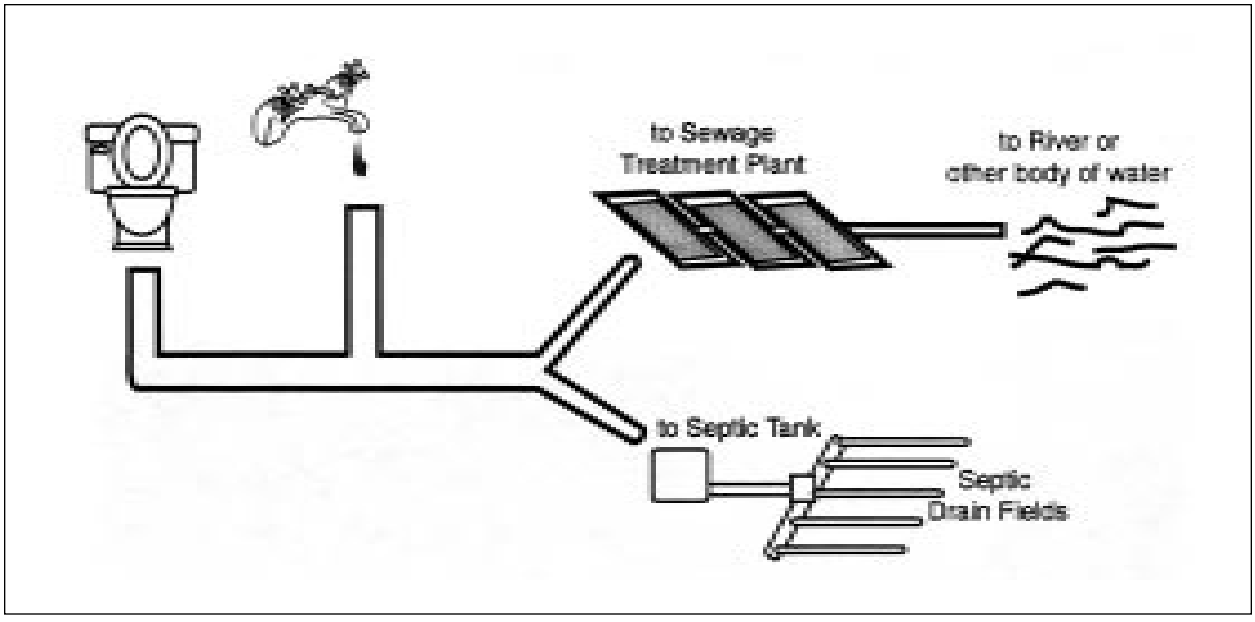
If a substance is poured down the sink or flushed down the toilet, where does it go? It goes either to the community sewage treatment plant or into a septic system.

The sewage system consists of a network of underground pipes that collect waste water from each house, store, office, factory, and building and bring it together into huge pipes called trunk lines. These trunk lines carry enormous volumes of waste.

Not long ago, sewage was dumped directly into rivers, lakes, and oceans. Now, most cities and towns have municipal sewage treatment plants to remove sewage before the transporting water is pumped into nearby lakes, rivers, or the ocean.

If a house is not connected to a sewer system, it is probably connected to a septic tank. Many gallons of water and sewage go through these septic systems each day.

Bacteria break down much of the waste entering a septic system. However, if household hazardous waste is poured or flushed into a septic system, the waste can kill this helpful bacteria and can contaminate the septic tank sludge or septic system's drain field soil. This sludge, pumped every four or five years from the septic tank, is disposed either at a sewage treatment plant in a septic lagoon or in a sludge landfill.



Student's Page

D. GARBAGE CAN

Until recently, once you had put your trash in the garbage can, you probably didn't think about it any more. The garbage truck came by every week and took it away. What happens to your garbage after it's picked up? Where does it go?

In some areas, the garbage truck takes your trash to a transfer station. From there, the garbage is placed in large trucks and hauled to a landfill. What happens to garbage after it reaches the landfill? What do you think can happen to household hazardous waste if you put it in the garbage?

Many years ago, trash in landfills used to be burned to reduce the volume. This produced a relatively nontoxic ash, but burning trash sent hazardous emissions into the air. Consequently, open burning was stopped and was replaced by compaction and burial of waste. The waste at a landfill is heavily compacted. As a result, almost any container will break and the contents will spill. If those contents are hazardous and they leach through the landfill into the ground, they will pollute the surrounding soil if the landfill is old and not properly lined with plastic to contain the leachate.

In addition rainwater soaks through the garbage. Soluble (dissolvable in water) substances from household hazardous waste may be washed down with them. This liquid mixture is called leachate. Leachate will go down through the soil until it reaches an impermeable layer (a layer it cannot go through), or it will flow downhill over the land's surface. Leachate can contaminate groundwater and surface waters. Landfills constructed today must have a protective lining, a leachate collection system, and a groundwater monitoring system. However, many of our existing landfills were established prior to these requirements, and they can leak hazardous leachate into the ground.

So if household hazardous waste is thrown into the garbage can, it may end up in the soil, the ground, or in water near a landfill.

These protective layers keep the leachate from contaminating the groundwater. A plastic liner is covered with a geotextile cushion followed by a layer of sand at the Eastlake Sanitary Landfill in Lake County. Garbage will be placed on top of the sand. Note the leachate pond on the right into which leachate is collected from the landfill.

Student's Page

WHERE WILL IT END UP?

Names of students:_____

Type of disposal method your group was assigned:_____

Answer the following questions. Then use the chart below to check off the areas affected by the disposal method you were assigned.

1. If we dispose of the household hazardous waste by this method, what might happen?
_____

2. What ways, if any, might other living things, like wildlife and plants, be harmed?
_____

3. What ways, if any, might people be harmed?
_____

4. How could chemicals in this product get into our drinking water?
_____

Product: Used Motor Oil						
Disposal choice	**Affected parts of the environment**					
	Air	Water	Soil	Humans	Wildlife	Plants
Pour the HHW* on the soil or on the ground.						
Pour the HHW on the street into a storm drain.						
Pour the HHW down the sink or toilet.						
Throw the HHW into the garbage can.						

*HHW = household hazardous waste

4–6 Module Unit 4

Transparency

WHERE WILL IT END UP?
EFFECTS OF HOUSEHOLD HAZARDOUS WASTE DISPOSAL

Chart I

Product: Used Motor Oil						
Disposal choice	**Affected parts of the environment**					
	Air	Water	Soil	Humans	Wildlife	Plants
Pour the HHW* on the soil or on the ground.						
Pour the HHW on the street into a storm drain.						
Pour the HHW down the sink or toilet.						
Throw the HHW into the garbage can.						

*HHW = household hazardous waste

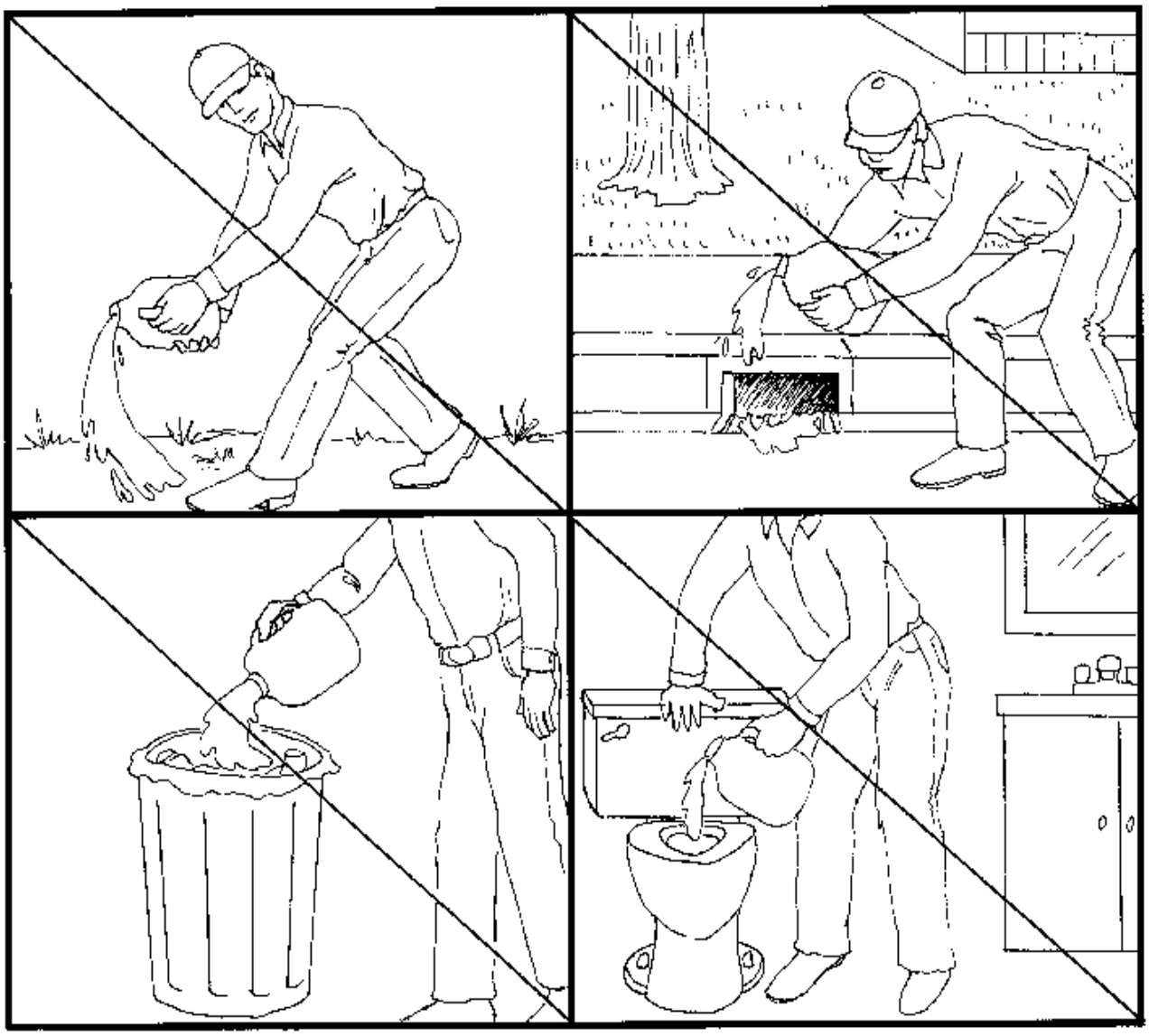
Chart II

Product: _____						
Disposal choice	**Affected parts of the environment**					
	Air	Water	Soil	Humans	Wildlife	Plants
Pour the HHW* on the soil or on the ground.						
Pour the HHW on the street into a storm drain.						
Pour the HHW down the sink or toilet.						
Throw the HHW into the garbage can.						

*HHW = household hazardous waste

Transparency

IMPROPER WAYS OF GETTING RID OF USED OIL



Why is each method of disposing of used oil, as shown above, not appropriate?

BACKGROUND INFORMATION FOR THE TEACHER

Many potentially hazardous products that people use at home and wastes, such as used motor oil, are called household hazardous waste when they are discarded.

It may not seem serious for individual households to improperly dispose of small quantities of household hazardous waste. However, even tiny amounts, such as parts per million or even parts per billion, of some substances will render a water supply undrinkable and dangerous to humans and other life. Some chemicals can produce such an effect after accumulation of minute amounts over many years.

Burying or pouring household hazardous wastes on soil is illegal and can damage or kill trees and other plants and contaminate water resources. Improper disposal of household hazardous wastes in wastewater systems (e.g. pouring down drains) can damage pipes and eventually damage sewage treatment equipment or home septic tank systems, because both of these processes are dependent on the actions of microbes to break down wastes. Pouring liquid waste (e.g., used motor oil or used antifreeze) on the street, driveway, or storm drain can pollute surface waters, such as streams and lakes.

Although unused motor oil is not considered a household hazardous product, once it has spent time inside an engine and is drained out, it becomes household hazardous waste. During engine use, the oil picks up metals, such as iron, lead, and cadmium; chemical contaminants; and dirt and ash. These contaminants and the motor oil are damaging to the environment.

Each year in California, approximately 20 million gallons of used oil are improperly disposed by persons changing their own oil. One quart of used motor oil can change the taste or smell of more than 250,000 gallons of fresh drinking water. This is enough water to sustain a family of four for one year.

There are many ways in which millions of gallons of used oil enter and pollute our environment each year. Many people change their own automobile oil and often dispose of the used oil on the ground or down storm drains and sinks, or throw it out with their trash. Limited understanding of the associated environmental and health hazards are prime causes of improper disposal. Additional information on used oil is provided in "Appendix C–V, Motor Oil."

Information about proper management of household hazardous waste is provided in Lesson 4. For additional information see "Appendix B–VI, Household Hazardous Wastes."

LESSON 4: Proper Management of Household Hazardous Waste

LESSON'S CONCEPTS

- Household hazardous waste must be carefully separated from other wastes and taken to a household hazardous waste collection facility.
- Used motor oil must be taken to a used oil collection center.

PURPOSE

Students will learn the proper way that household hazardous waste should be managed.

OVERVIEW

In this lesson students will:

- Visit the school bus yard and interview a mechanic to find out what happens to used motor oil and used motor oil filters from school buses.
- Find out where in their community used motor oil can be recycled.
- Listen to a speaker describe the proper way to manage household hazardous waste.
- Determine that by recycling used motor oil and other recyclable household hazardous wastes, natural resources are conserved and the environment is protected from pollution caused by the improper disposal of wastes.

CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND FRAMEWORKS AND TO *BENCHMARKS FOR SCIENCE LITERACY*

- Students determine where in their community household hazardous waste, including used motor oil, must be taken. Students conclude that when household hazardous waste is properly managed, natural resources can be conserved and protected.
  - "Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding this concept . . . students will: . . . formulate predictions and justify predictions based on cause and effect relationships." (*Science Content Standards, Grades K–12*; Grade 4; Investigation and Experimentation, Standard 6c)
  - "(People) need to exercise judgment, care, and planning in their use of natural resources . . . and in their practices of disposing of wastewater and materials." (*Science Framework*, page 125)
  - "Discarded products contribute to the problem of waste disposal. Sometimes it is possible to use the materials in them to make new products . . .." (*Benchmarks for Science Literacy,* page 189)
- Students describe in their journals why used motor oil should be taken only to a used motor oil collection center for recycling and should never be disposed of in the environment.
  - Students "select a focus, an organizational structure, and a point of view based upon purpose, audience, length, and format requirements." *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 23)
- Students write thank you letters to the speaker.
  - Students "choose the form of writing (e.g., personal letter . . .) that best suits the intended purpose." *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 37)

SCIENTIFIC THINKING PROCESSES

observing, communicating, ordering, relating

TIME

15 minutes to prepare for the lesson; 60–90 minutes to implement the lesson

VOCABULARY

household hazardous waste collection facility (Select additional words that students are curious about in this lesson.)

PREPARATION

___ **1.** Read the "Background Information for the Teacher" on page 563.

___ **2.** Make arrangements for your class to visit your school's or district's bus yard. You should first ask permission from an administrator. Ask a mechanic at the bus yard to show students the tools he or she uses to change the oil and the container in which used motor oil is placed and to show or describe to the students where the used motor motor oil is taken. If a field trip to the bus yard is not feasible, obtain permission from the appropriate administrator and then ask a mechanic from the bus yard to speak to the class. Make certain to provide the mechanic with a list of questions that students will be asking, including information about recycling used motor oil and filters.

___ **3.** Identify agencies and organizations that deal with the proper disposal of household hazardous wastes, including used motor oil, used motor oil filters, paint, and used antifreeze. Call the local recycling center, County Household Hazardous Waste Coordinator, or health department to find out about disposal procedures and other related issues, including locations of local household hazardous waste collection centers or events. You can also call the California Environmental Protection Agency's Environmental Hotline at 1-800-CLEAN-UP for locations of used oil collection centers. Make a phone list of your local resources. Ask whether agencies dealing with used motor oil and other household hazardous waste in your community can send you handouts and other information. Also ask whether a speaker can visit your class.

___ **4.** Invite a speaker to talk about the safe disposal and recycling of household hazardous waste.

___ **5.** Collect a total of four empty containers. Three should be from the following household hazardous products: antifreeze, paint thinner, and pesticide (weed or insect killer). Each of these three containers should have some type of warning information. You might be able to get some of these from the school's custodian and some from your home. Write "used antifreeze" on the antifreeze container. Also collect a plastic one-gallon jug and write "used motor oil" on it.

Safety Note: For added safety, tape the lids on all containers that previously held household hazardous products.

___ **6.** Make a copy of "Items That Should Go to a Household Hazardous Waste Collection Center" for each pair of students (page 559).

___ **7.** Make a transparency of "Recycling Used Motor Oil" (page 560).

MATERIALS

For "Part I, Learning About School Buses and the Proper Management of Used Oil"

___ New motor oil filter

___ Four empty containers, one of each: plastic 1-gallon jug (with the words "used motor oil" written on it), antifreeze (with words "used antifreeze" on it), paint thinner, and pesticides (weed or insect killer).

___ The transparency of "Recycling Used Motor Oil"

For "Application"

___ A copy of "Items That Should Go to a Household Hazardous Waste Collection Center" for each pair of students

PRE-ACTIVITY QUESTIONS

A. Define with your students the terms *hazardous product* and *hazardous waste* and review the four major categories of hazardous substances. *A hazardous product may contain substances that may be corrosive, ignitable, reactive, or toxic. Once the product is no longer wanted by the consumer, the product becomes household hazardous waste.*

B. Show students the three empty containers from household hazardous products; then lead a discussion:

- Each container has some type of warning information. Is this warning for the contents inside or for the container? *The contents inside.*
- If the container is totally empty, what can be done with it? *It might be able to be recycled or can be placed in a trash can.*
- When do people want to dispose of a household hazardous product*? When they no longer want it and it becomes household hazardous waste.*
- Could they give a household hazardous product in its original container (for example, toilet bowl cleaner) to a neighbor to use? *Yes.* Tell students that it is recommended that the entire contents in the container of a household hazardous product be used up. If a family no longer wants to use it and someone else wants to use it properly, then the family can give it to someone else.
- If a family cannot give away a container that still has some household hazardous product in it (and since the family no longer wants it, is it now considered household hazardous waste), then what can the family do with it? *Don't know; take it to a special place; throw it away*. If a student says "to put it in the garbage can," tell students that it is against the law to put household hazardous wastes, even if they are in a container, in the garbage can. One of the reasons is that if the container breaks or bursts when it is compacted in the garbage truck, transfer station, or landfill, the product could injure the people who work at these places. Also, when the container rusts or breaks down through time in a landfill, the hazardous contents will leak from the landfill into surrounding areas.

C. Tell students that some household hazardous wastes are not just products you no longer want, but could be products that have been used and contaminated.

- Ask whether anyone has an idea of what type of products these would be. *Used motor oil, used oil filters, used antifreeze, used batteries.*
- Show students the plastic one-gallon jug with the words "Used Motor Oil."
- Ask students what people can do with used motor oil that will not pollute the environment. *It can be recycled*. (Students might not yet know that used motor oil can be recycled and that it is the only legal way to get rid of it.)

D. Discuss what students think is the only option for getting rid of used motor oil. Refer to what students said in "Pre-Activity Questions" in Lesson 3. Accept all answers at this time.

E. Tell students that used motor oil can be recycled. Does anyone know what other household hazardous wastes can be recycled? (Students might or might not know that used motor oil filters, used antifreeze, latex paints, and used batteries can be recycled.)

F. How can used motor oil filters, used antifreeze, latex paint, and used batteries cause problems if disposed of improperly? *They can pollute the soil and water and affect living things in the soil and water.*

G. What do you think happens to the used motor oil and filters from the school buses? *They are recycled*.

PROCEDURE

Part I, Learning About School Buses and the Proper Management of Used Motor Oil

A. Tell students that they will be visiting their school's or district's bus yard (garage) or a mechanic from the bus yard will be visiting their class. Ask them to make a list of questions for the mechanic. Some of those questions should be on where the used motor oil and filters are taken for recycling. Other questions students can ask are:

- How often is the oil in each bus changed?
- How many buses are there?
- What is the total amount of used motor oil and antifreeze and the number of batteries that are recycled at the bus yard?

B. List questions on the chalkboard or on a piece of butcher paper. Ask one student to copy down the questions to be sent to the mechanic. Decide who will ask what questions and who will record the answers to the questions.

C. Show students what a new motor oil filter looks like. Ask students what a used motor oil filter might look like. *It will be dirty, oily*. Tell students that they should ask the mechanic to show them a used motor oil filter.

D. If students are going on the field trip, do #1 that follows. If the mechanic is coming to talk to the class, do #2. Either way, make certain to provide the mechanic with a list of questions that students will be asking, including information about recycling used motor oil and filters.

1. Lead students to your school's or district's bus yard. Ask a mechanic at the bus yard to show students the tools he or she uses to change the motor oil, the container into which used oil is placed, and a used motor oil filter. The mechanic should also tell students where the used motor oil is taken. Then have students ask the mechanic the questions they have developed. Students should record the mechanic's answers.

2. If a field trip to the bus yard is not feasible, ask a mechanic from the bus yard to speak to the class. Perhaps the mechanic can bring the container in which the used oil is stored.

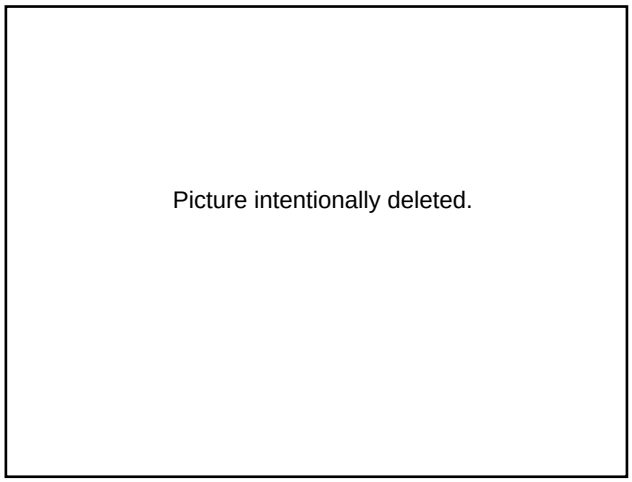
E. When the speaker is gone, review the questions and answers with the class. Have students write down where the used motor oil from school buses is taken.

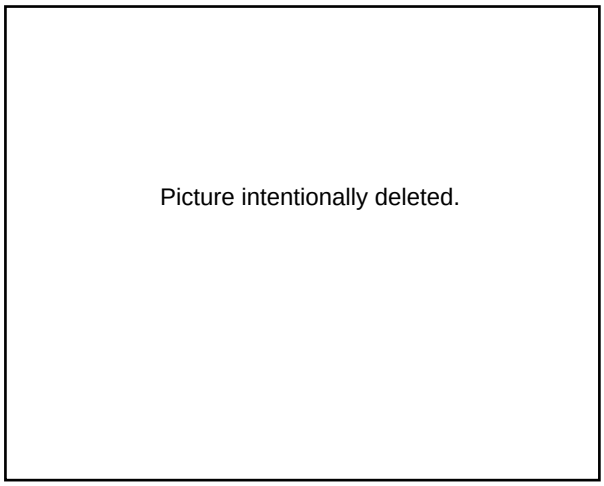
F. Have students write thank you notes to the speaker and include some drawings.

G. Ask students how they can find out where the household hazardous waste collection facility is located and where else in the community used motor oil and used motor oil filters are accepted for recycling. Allow student volunteers to call the California Environmental Protection Agency's Environmental Hotline at 1-800-CLEAN-UP and local agencies and gas stations to find out this information. (This information might also be available from the handouts you have acquired from local agencies.)

H. Show students the gallon plastic jug labeled "used motor oil" and the transparency of "Recycling Used Motor Oil."

- Discuss the importance of recycling used oil and ask students to explain the illustrations on the transparency.
- What is the only legal and environmentally safe way to get rid of used motor oil? *Take it to the local household hazardous waste collection facility or other center des-*





Students from Janet Cohen's sixth-grade class at Gold Trail Elementary School go on a field trip to their school district's bus yard and learn about the importance of recycling used motor oil.

ignated by their community (e.g., a specific gas station).

- How does recycling used motor oil conserve natural resources?

Note: If students have completed the Unit 1, "Managing and Conserving Natural Resources," in the 4–6 Module, they should be able to answer the previous question. If they have not participated in lessons on natural resources, ask them to conduct research to answer the question about how recycling used motor oil conserves natural resources.

I. Show students the empty container of antifreeze. Let a student read the caution label. Tell students that children and pets have been known to die from drinking this. What should be done with the used antifreeze? *It should be recycled at a household hazardous waste collection facility.*

Safety Note: Emphasize to students that only adults should be taking the household hazardous waste to a proper household hazardous waste collection site. Students should use these products at home only if permission is given by their parents or guardians and only if they take proper precautions, such as wearing gloves, and are supervised by an adult.

Part II, Listening to a Speaker About the Proper Management of Household Hazardous Waste

Do A or B.

A. If you have arranged to have a speaker from a household hazardous waste collection site, do the following:

- Develop a list of questions with students on what to ask the speaker. For example:
  - What type of household hazardous waste is accepted at the household hazardous collection site?
  - What happens to the waste that is brought to a household hazardous waste collection center?
- Have the speaker talk to students about the household hazardous waste collection site in the community. Students should learn that the first way to deal with a household hazardous product is to use it all up. Then the container can be recycled or placed in the garbage can (depending on your community's recycling opportunities and the directions, if any, on the container).
- After the speaker is gone, ask students to identify one thing that they learned from the speaker.
- Have students write thank you letters to the speaker. Some students' drawings could be included in the thank you packet sent to the speaker.

B. If you could not arrange for a speaker, share with students the information in "Household Hazardous Waste Management Options" and make certain that they can answer the questions in the "Discussion/Questions" below.

DISCUSSION/QUESTIONS

Ask students:

- What is the first priority for managing household hazardous products to keep them from becoming household hazardous waste? *Use the product up.*
- What if you cannot or do not want to use the product up*? Give it away or take it to the household hazardous waste collection facility.*
- What should you do with the empty container*? It can be recycled or placed in the garbage can* (depending on your community's recycling options).
- What household hazardous wastes can be recycled? (This will depend on your community's recycling options.) *Used oil, used oil filters, used antifreeze, used batteries, paint.*
- Name three items that can be taken to a household hazardous waste collection site or event. *Batteries, cleaning products, paints, automotive products, pesticides, medicines.* (Note that this list will vary from community to community).
- What products could be used in place of the ones containing hazardous materials?

APPLICATION

A. Ask students to brainstorm ways that they can prevent household hazardous substances from harming the environment. Ask them to suggest solutions that they themselves might do, such as:

- Buy fewer products that contain hazardous materials.

- Use up what you have or find someone who can use them properly.
- Take the waste to a hazardous household waste collection site or a recycling center that handles hazardous substances.

B. Ask students to write in their journals how recycling recyclable household hazardous wastes, such as used motor oil and used motor oil filters, reduces the need to extract more oil from the Earth (therefore conserving natural resources) and protects the environment from pollution.

C. Distribute a copy of "Items That Should Go to a Household Hazardous Waste Collection Facility" to each pair of students. Ask them to complete the chart. Make a master class list and post it in the classroom. Keep this to use in Lesson 5.

Note: In Lesson 5 students will determine how they can share, with their families and other people, the information about household hazardous wastes and which wastes are accepted at their communities' household hazardous waste collection centers.

Note: Complete the blanks in "Household Hazardous Waste Management Options" for students to use in Lesson 5.

EXTENSION

Play the game described in the *Closing the Loop*, Household Hazardous Waste Unit, K–3 Module, Lesson 3. In this game students participate in a relay race to separate various pictures of wastes according to their appropriate disposal options. You will need to adjust this game for the grade level of your students.

RESOURCES

Videos

Hazardous Waste, Whose Problem Is It Anyway? 1989 (10 minutes). Available from the Environmental Health Coalition, San Diego.

A class goes to different rooms in a house and looks at the problems of household hazardous products and wastes. Discusses the importance of reading labels, storing household hazardous products safely, and disposing household hazardous waste properly.

Outta Sight, Outta Mind. 1978 (11 minutes). Available from the Environmental Health Coalition, San Diego.

A grandfather and his grandson are out in a boat and discuss the problems created by household hazardous products and wastes and the solutions to those problems. Stresses the importance of reading labels, using these products safely, understanding how chemicals can affect us, and disposing properly of household hazardous waste.

Peter Paint and Pals in the Hunt for HHW. Rancho Cucamonga, Calif.: Creative Edge Communications, 1997 (8 minutes). Produced for the City of Chino.

Cartoon-type characters representing various household hazardous products explain why some household hazardous waste disposal methods are not acceptable and discuss how to properly dispose of household hazardous waste. Although this video was designed for primary grade students, the information provided is also valuable to older students.

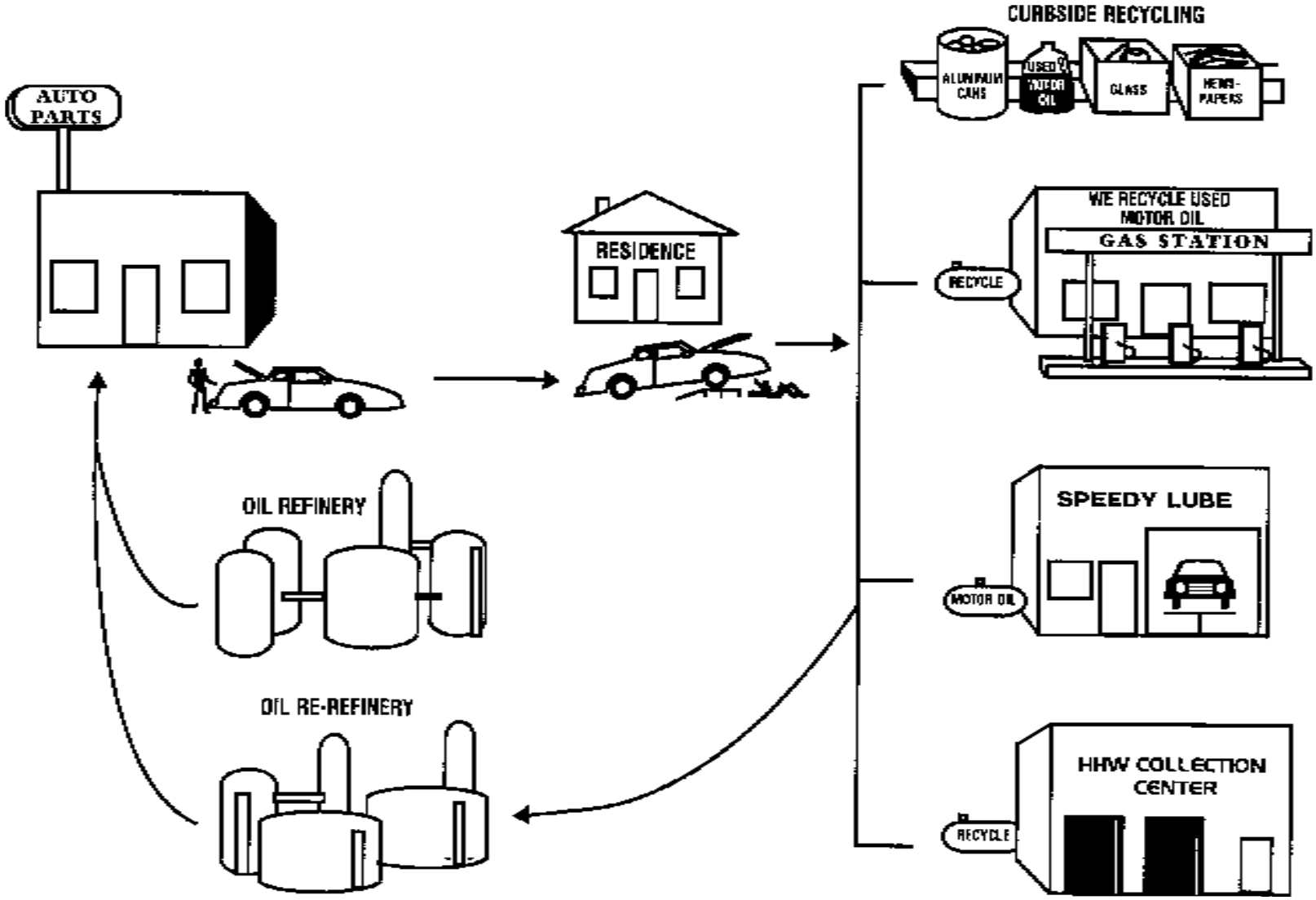
Student's Page

ITEMS THAT SHOULD GO TO A HOUSEHOLD HAZARDOUS WASTE COLLECTION CENTER

The following household hazardous wastes are accepted at our local household hazardous waste collection center:

Transparency

RECYCLING USED MOTOR OIL



Teacher's Pages

HOUSEHOLD HAZARDOUS WASTE MANAGEMENT OPTIONS

Recommendations for Household Hazardous Products and Household Hazardous Wastes (HHW)

- Keep all household hazardous products and wastes out of the reach of children and pets.
- Read the label before handling any household chemicals.
- Avoid mixing household wastes together for disposal.
- Avoid putting a hazardous product in anything but its original container or a container specifically designed for household hazardous waste, such as used motor oil.
- Use the product up. (Follow directions on the container's label on how to properly dispose of the empty container and check to see whether your community recycles these containers.)

•HHW collection events are conducted _____

_____

For more information about disposal and/or recycling/reuse options of HHW, please call

_____

•HHW collections centers are _____

_____

Actions to Take Concerning HHW (In the order recommended by the California Integrated Waste Management Board)

A. Reduce

Identify household hazardous products that you can reduce the use of. Consider whether you really need them. Purchase only the amount you really need.

B. Reuse (In the case of HHW, reuse means to make certain the product is completely used).

Whenever possible, use up the product or give it to someone who will use all of it. For example, reuse paint solvents by letting the paint sludge settle and then reuse the solvent. Some charities accept excess paints that they will use.

C. Recycle

In our community the following household hazardous wastes can be recycled: used oil, used oil filters, and antifreeze, batteries, and paints.

- Used automobile oil and used oil filters can be recycled at_____

Note: Recycling used oil is the **only** legal and environmentally safe way of handling this product.

Recycle antifreeze at _____

For additional information, call the California Environmental Protection Agency's hotline at 1-800-CLEAN-UP.

- The household hazardous waste collection site or event for our community is at

_____

and accepts the following HHW:

_____

_____

- None of the above products should ever be placed in the trash can, poured down the drain in the street, on the ground, or in the storm drain.
- The HHW collection facilities or HHW collection events in our community do not accept _____

_____

_____

Safe Storage at Home

When the consumer is finished using a product, any remaining product should be stored safely in the home in its original container. Read the original product label for safe storage requirements; if the label falls off, clearly relabel the storage container; secure in an area that is inaccessible to children and animals; and check regularly for any leaks. Also keep the products away from moisture, water, and food; and never mix one product with another.

Pesticides, acids, corrosives and their empty containers, flammables, paints, paint removers, wood preservers, used motor oil, used motor oil filters, and used antifreeze should be stored until taken to a collection center or until there is a scheduled household hazardous waste collection day in your area.

BACKGROUND INFORMATION FOR THE TEACHER

The best way to manage most household hazardous waste is to reduce consumption and use up the entire product that was purchased. Any leftover hazardous substances or used products (e.g., used motor oil) should be taken to a household hazardous waste collection facility for proper handling and treatment or given to a friend who needs to use it. These are the only safe and legal options for managing household hazardous wastes.

The improper disposal of used motor oil and used oil filters, used antifreeze, paint, and used car batteries is against the law. All of these items can be recycled. Used motor oil can be re-refined and used again indefinitely as a lubricant. Used oil filters can be taken apart, the oil drained and recycled, and the parts used to make other steel products.

Recycling used motor oil and other recyclable household hazardous waste protects the environment from pollution caused by the disposal of these wastes. Through recycling, natural resources are conserved.

The following information explains the management of household hazardous waste that citizens should implement.

Recommendations for Household Hazardous Wastes (HHW)

- Keep all household hazardous products and wastes out of the reach of children and pets.
- Read the label before handling any household chemicals.
- Avoid mixing household hazardous wastes together.
- Avoid putting a hazardous product in a different container.
- Use the product up before recycling the empty container or disposing of the container in the garbage to go to the landfill. (Follow directions on the container's label on how to dispose properly of the empty container and check to see whether your community recycles these containers.)
- Call the local County Recycling, Health Department, or Household Hazardous Waste Coordinator to learn proper recycling/reuse options in your community.
- Take all household hazardous waste to a household hazardous waste collection facility or event in your community, where they will reuse, recycle, or safely store these wastes.

Actions to Take Concerning the Management of Household Hazardous Wastes (in the order recommended by the California Integrated Waste Management Board)

A. Reduce

Identify household hazardous products that you can reduce the use of. Consider whether you really need them. Buy only what you need.

B. Reuse

Whenever possible, use up the product or give it to someone who will use all of it. For example, reuse paint solvents by letting the paint sludge settle and then reuse the solvent. Some charities or drama clubs accept excess paints that they will use. Household hazardous waste collections programs offer reuse opportunities.

C. Recycle

Recycle those household hazardous wastes that can be recycled in your community. For consumers this means taking all their household hazardous wastes to collection centers, facilities, and/or events. Used oil, used oil filters, used antifreeze, used batteries, and leftover paints are the principal household hazardous wastes that can be recycled. Household hazardous wastes should never be poured into storm drains or sewers, because these may be directly connected to streams or other bodies of water and will pollute the water. They should never be placed in a garbage can to be taken to a landfill.

To find out how and where to recycle paints, used automobile oil, used oil filters, and antifreeze, call the local county's Recycling or Household Hazardous Waste Coordinator or the California Environmental Protection Agency's Environmental Hotline at 1-800-CLEAN-UP. Taking household hazardous wastes to a collection facility is the only legal and safe way to manage any household hazardous waste.

- Many cities and counties have a permanent household hazardous waste collection facility.

For more information see "Appendix B–VI, Household Hazardous Wastes."

Note: The California Integrated Waste Management Board (CIWMB) provides grants to local governments for local used motor oil programs, which can include efforts to maintain existing and establish new curbside collection efforts, conduct public education programs, and support certified used oil collection centers. (Other related efforts are also allowable.) There are over 2,300 certified centers in California. This makes it convenient for those who change their own motor oil and filters to dispose of it in an environmentally responsible way.

Pesticides, acids, corrosives and their empty containers, flammables, paints, paint removers, used oil, used oil filters, and wood preservers should be stored safely until you can take them to a household hazardous waste collection facility or to the location of a scheduled household hazardous waste collection in your area.

A household hazardous waste collection vehicle from the cities and county of Stanislaus.

LESSON 5: Promoting Proper Management of Household Hazardous Waste

LESSON'S CONCEPT

Education and publicity can help encourage people to manage properly their household hazardous waste.

PURPOSE

Students demonstrate what they have learned about the proper management of household hazardous waste by taking personal action. Through various projects students encourage others to manage properly their household hazardous waste.

OVERVIEW

Students select one of the following projects to complete to teach others what they have learned about household hazardous waste:

- Design posters to inform students and other community members that the only way that household hazardous wastes can be managed properly is to take them to a household hazardous waste collection facility or event in their community.
- Compile a list of facts about used motor oil or other household hazardous waste and design a community display.
- Make hanging signs for door handles with reminders to recycle used oil, used oil filters, used antifreeze, and paint.
- Make a coloring book for younger students on the importance of avoiding household hazardous products or of managing waste properly.
- Write a letter to parents or guardians to inform them about household hazardous waste.
- Write a jingle about the proper management of household hazardous waste.

CORRELATIONS TO CALIFORNIA'S CONTENT STANDARDS AND TO *BENCHMARKS FOR SCIENCE LITERACY*

Students complete projects to teach others about the proper management of household hazardous waste. They present these to the class. Some students compile a list of facts about used motor oil or other household hazardous waste and make a coloring book for younger students.

- "People can learn from each other by telling and listening, showing and watching, and imitating what others do." (*Benchmarks for Science Literacy,* page 140)
- Students "choose the form of writing (e.g., personal letter, letter to the editor, review, poem, report, narrative) that best suits the intended purpose." *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 37)
- "Students deliver brief recitations and oral presentations about familiar experiences or interests that are organized around a coherent thesis statement. *(English–Language Arts Content Standards for California Public Schools, Kindergarten Through Grade Twelve*, page 27)

SCIENTIFIC THINKING PROCESSES

observing, communicating, comparing

TIME

10 minutes to prepare for the lesson; 45–120 minutes to implement the lesson (depending on how long students take to complete their projects; some can be completed as a homework assignment)

VOCABULARY

(Select additional words that students are curious about in this lesson.)

PREPARATION

___ **1.** Read the "Background Information for the Teacher" on page 568.

___ **2.** If you have obtained information packets concerning the disposal of household hazardous waste in your community, prepare copies for students to take home.

MATERIALS

___ Magazines and newspapers
___ Information from local sources about the proper management of used motor oil and other household hazardous waste
___ Completed copy of "Household Hazardous Waste Management Options" from Lesson 4 (pages 561 and 562).
___ Students may need specific materials to complete their projects.

PRE-ACTIVITY QUESTIONS

A. Ask students:

- What can we do to encourage others to manage properly their household hazardous waste?
- What is an advertisement? *A news article, TV commercial, notice in a newspaper, store display; anything that brings something to one's attention or notifies someone about an object, event, or idea.*

B. Show examples and ask students to share with the class some advertisements from magazines or newspapers. Discuss:

- What product or company is being promoted?
- What audience is being targeted in particular; e.g., young people, women, wealthy people?

C. What are slogans? *Catchy phrases.* What slogans are being used in the advertisements? Ask students to think of some well-known slogans that they may have heard on television (e.g., "It's the real thing.").

- What do you remember about them? *The words and what they represent.*
- What makes them so powerful? *They are phrases that are easy to remember; some are funny.*

D. Discuss some jingles (songs) that students have heard that promote an idea or product.

Homework Assignment: Assign students to watch television, listen to the radio, or read advertisements and to report back to the class a slogan or jingle used in one advertisement.

PROCEDURE

A. Ask students to share their homework assignments.

B. Tell students that they will be selecting a project to teach others about the proper management of household hazardous waste. They can use some advertisement techniques that they have observed to help them with their projects. Discuss some techniques.

C. Ask students for important ideas that they have learned about household hazardous waste that they could use in their projects.

- As a class, develop a bank of key words and phrases that address household hazardous waste. Students should focus on what people should know about household hazardous waste and why.
- Post the class list of "Items That Should Go to a Household Hazardous Waste Collection Facility" that was developed in Lesson 4. Tell students that they can use this list in some of their projects to let people know what type of household hazardous waste is collected in their community.
- As a class, consider designing a rubric or make a list of criteria for the projects, so that students will know how their work will be assessed. See Unit 2, Lesson 6 for an example of a rubric.

D. Tell students that they can work individually, in pairs, or in groups, or decide to do a project as a class. Provide any handouts of household hazardous waste that you received from local agencies. Share with students the following ideas for projects (they can also design a project of their own):

1. Poster. A poster should inform students and other community members of the importance of taking household hazardous wastes to the household hazardous waste collection facility. A poster can be designed to show ways that household hazardous wastes should never be disposed of and include the reasons why. Or a poster

could contain a list those household hazardous wastes that are accepted at the local household hazardous waste collection facility. Or a poster could include the proper way to manage used motor oil.

2. **Display.** A display may have examples of handouts from the local household hazardous waste collection facility and include directions to community members on how to manage safely their household hazardous wastes. A display can also have facts about used motor oil and other household hazardous waste. This display can be put up in various areas in the community.

3. **Door Handle Sign.** Door handle signs can be cut out of cardboard and used as reminders on door handles. Students might want to develop a slogan or directions for the cardboard door handle signs. For example, "Don't spoil the soil with that oil!" or "Recycle your used oil: protect our waters." They can add illustrations.

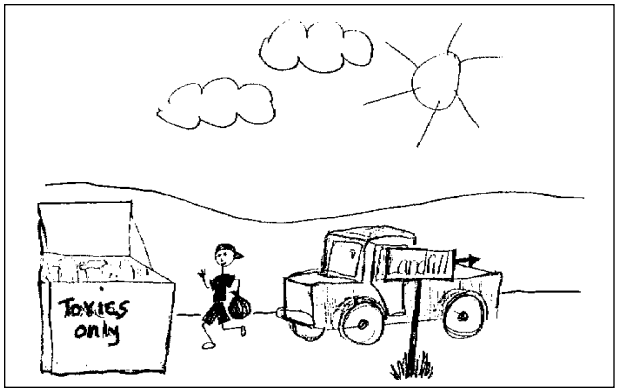
4. **Coloring Book.** A coloring book can be designed for younger students to teach them the importance of avoiding household hazardous products and waste. This could be a class effort. If the class decides to do a coloring book, each student can contribute to the illustrations or to the descriptions under the illustrations. Encourage students to keep it simple. See the example on the next page.

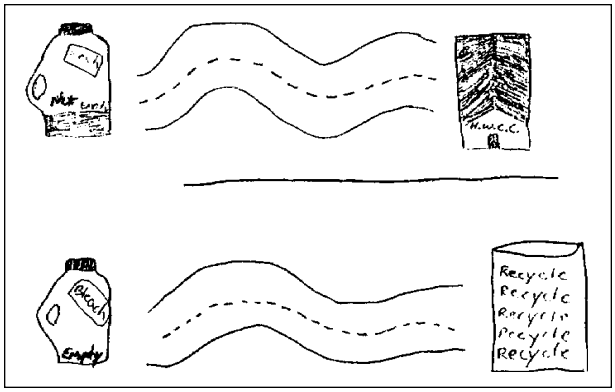
5. **Writing Letters to Parents.** A letter could be written to parents about recycling used motor oil and the proper management of other household hazardous wastes. Two examples of letters are provided in this lesson. One provides information about managing household hazardous waste (page 569), and the other describes facts about used motor oil (page 570).

6. **Jingle.** A jingle or a song based on a well-known song can be written to promote the proper management of household hazardous waste.

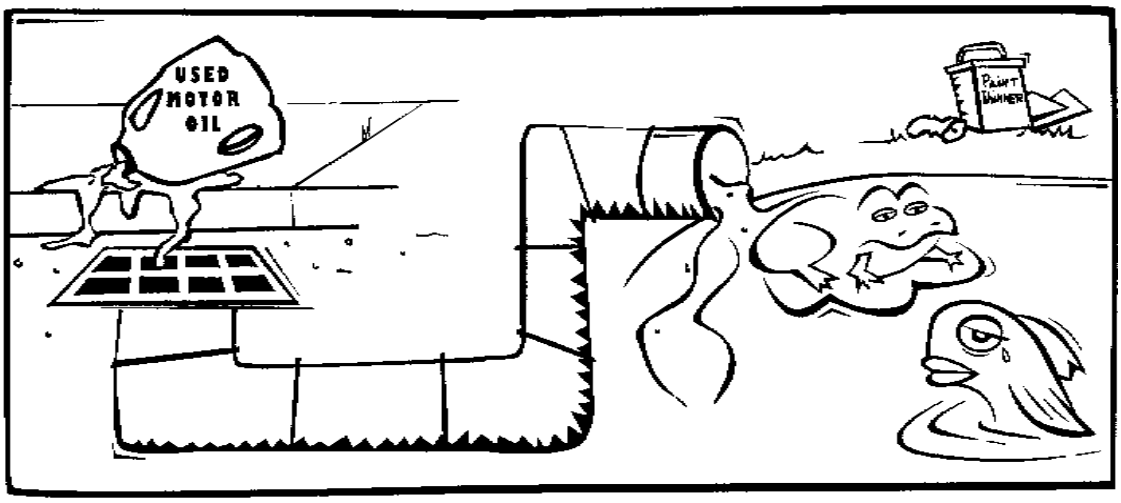
7. **Other Projects**

   - Students could create a map that shows the locations of household hazardous waste disposal sites in their community. If there is not a household hazardous waste collection site in your community, students might want to organize a letter-writing campaign to community officials to encourage the development of a household hazardous waste collection site.
   - Students could write news articles about the importance of properly managing household hazardous wastes. These can be submitted to the school's newspaper or to a local paper; or students could create their own newsletter to promote community awareness of household hazardous waste. They can advertise locations that accept used motor oil and other household hazardous wastes. They can also describe events where people will volunteer to paint buildings in their community using donated unused house paint.





Submitted Janet Cohen, sixth-grade teacher, Gold Trail Elementary School, Gold Trail Union School District.



Don't Dump Down Storm Drain

Dangerous To Animals

D. Allow students some class time to work on their projects. Some students might need to complete theirs at home.

E. Encourage students to share their projects.

DISCUSSION/QUESTIONS

A. How do slogans, jingles, signs, and displays help to advertise how to manage properly household hazardous waste?

B. What do you think people will notice about the posters, signs, displays, or jingles that you have designed?

APPLICATION

Homework Assignment: Ask students to write a pledge to do one thing to promote the importance of the proper management of household hazardous waste. They should begin by writing, "I pledge to . . .."

Encourage students to share their pledges.

BACKGROUND INFORMATION FOR THE TEACHER

In this lesson students do projects to teach others about what they have learned about household hazardous waste. If you received information from local sources about the proper management of household hazardous waste, provide these for students. Allow students to obtain additional information about household hazardous waste by visiting Websites, such as the California Integrated Waste Management Board's website: www.ciwmb.ca.gov. You might also make copies of some of the pages on household hazardous waste which you completed in Lesson 4 for students to use in their projects. Additional information on household hazardous waste is provided in "Appendix B–IV, Household Hazardous Waste" of this guide.

Letter to Parent or Guardian Concerning Household Hazardous Waste

(Use school's letterhead.)

Dear Parent or Guardian:

Please read the following information with your child:

Our class is studying household hazardous products. Since safety is our highest priority at school, we thought you might want to know what your child is learning about household hazardous products and waste. The following products can be hazardous:

- Automotive waste products (including used motor oil and used motor oil filters)
- Batteries
- Fuels
- Paints (including wood preservatives and paint solvents)
- Pesticides

Household hazardous products that are no longer wanted by a family are called household hazardous wastes. To protect people and water supplies and to keep our environment from becoming polluted, your community provides a household hazardous waste collection site where you can take your household hazardous wastes. Here are some warnings regarding any wastes you may have:

- Containers holding any leftover household hazardous products should never be placed in the trash. The products might injure garbage haulers and landfill workers and could pollute the environment.
- The contents should never be poured down the drain, on the ground, or into a storm drain, because the household hazardous wastes could pollute water and soil.

Here is what you should do to reduce the amount of your household hazardous waste:

- Buy only what you need and will be able to use.
- Use the product completely or give it to someone who could use it safely.

If you find it necessary to dispose of any unused hazardous products, take them to a household hazardous waste collection site. This is located at _____

_____

The telephone number to call for information about the proper management of household hazardous waste in our community is: _____

Thank you,

Letter to Parent or Guardian Concerning Used Motor Oil

(Use school's letterhead.)

Dear Parent or Guardian:

Please read the following information with your child:

Our class is studying about the proper recycling of used motor oil. Students have learned that:

- Approximately 20 million gallons of used motor oil are disposed of improperly by people who change their own motor oil in California each year.
- It is illegal to pour used motor oil onto the ground, into storm drains, and into trash cans, because the used motor oil can pollute our soil and groundwater.
- One quart of used motor oil can affect the smell and taste of more than 250,000 gallons of fresh drinking water. That is enough water to sustain a family of four for one year.
- Used motor oil can be recycled and used over and over again.

To protect people and water supplies and to keep our environment from becoming polluted, businesses in your community provide used motor oil collection sites. These are located at:

_____

_____

The telephone number to call for information about the proper recycling of used motor oil and oil filters in our community is: _____

The household hazardous waste collection site is located at:

_____

The telephone number to call for information about the proper management of household hazardous waste in our community is: _____

Thank you,